E05172

RAILWAYS:

AN

INTRODUCTORY SKETCH,

WITH SUGGESTIONS,

IN REFERENCE TO

THEIR EXTENSION TO BRITISH COLONIES.

BY

ROWLAND MACDONALD STEPHENSON.

PART I.

WITH ILLUSTRATIONS.

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RAILWAYS.

PART I.

RAILWAYS may, with equal force and propriety, be defined as the great modern instrument of civilization—the detached links of that extended chain which, at no distant date, shall connect the remotest ends of the world, and exercise upon the whole family of man a humanising and irresistible influence.

Their general principles may be regarded as the adaptation of mechanical contrivance for the diminution of friction in the ordinary appliances of locomotion, and a consequent reduction of time and space proportioned to the degree of perfection attained in the means employed.

Of their origin, progress, and present position, it is admitted that the collieries first benefitted by the use of wood and cast iron tramways, to convey heavy loads for short distances, at a cost for traction which speedily attested its superiority over the common road. The soundness of the principle gradually induced its extension. Flat stone tramways and wrought iron rails in endless variety of form underwent the test of examination and experiment, and after several years, and great, though perhaps unavoidable cost, the Railway system is firmly established upon a secure and solid base, with clear and defined general principles, and in course of rapid and universal extension.

Their use and abuse are the narrow and broad paths for selection by those to whose charge these great works are entrusted. The principles are sound. Upon their future application must depend the failure or success of the result.

The aggregate extent of Railway communication is not less than 17,555 miles. The length of lines is respectively in Europe, 11,105 miles; in Asia and Africa, 0; in America, 6,450 miles. The proportions constructed, in progress, and proposed in each country, are shewn in the Table at the commencement.

In considering the comparative advantages of the respective plans of construction and working, it must be remembered that the entire burthen of the costly experiment has been borne by England, and that foreign states have prudently awaited the results, and lost no time in profiting by them. The general characteristics of the English works are solidity and strength, durability and grandeur;—of the Belgian, Prussian, and others of the Continental works, simplicity, judicious economy, and especial adaptation of the principle to the exigencies and resources of the respective countries;—and of the American works, rigid and parsimonious economy, having for its object the extension over the greatest possible distance of the least quantity of materials, with a view to the speediest though least efficient opening of the communication, and assuming the cost of future relaying to be less onerous than the loss of interest upon the heavier and more substantial works.

Among the objections founded on past experience to particular practices, may be enumerated the extremes both of English and American works. A judicious combination of the solidity of the former with the simplicity of the latter, avoiding the manifest defects of both, will probably afford the means of securing the greatest attainable amount of permanent benefit, at the least possible cost.

Among the prominent defects of particular systems, and the errors to be especially avoided, are the excessive loads and strain to which Railways are subjected, by the needless weight of the engines recently constructed, far exceeding the powers of continued resistance of any permanent way that can be laid down—the insufficient regard paid to the essential element of complete success in a Railway, viz.:—that its cost of construction, maintenance and working, should be so regulated with reference to the wants of the community, as to admit of establishing the lowest possible rate of fares;—the neglect to recognise the importance of not entailing heavy after expenses, under an over-rated impression of the advantage of cheap construction at the outset;—and a too ready adoption of the mistaken views of enthusiastic admirers of the principle, who would adapt to circumstances totally dissimilar, a mode of construction and description of work which, however suitable in the one case, is frequently the least applicable in the other.

The practical illustration of these views will be contained in the second portion of this little work, in which will be found a collection of all the best Railway operations, arranged in such form as to admit of comparison, and of observing the respective superiority of each.

The most interesting enquiry in connection with the subject of Railways, now that their use in England has become so widely diffused, is the probability and the most effectual means of their extension to the British Colonies, under circumstances and within a period to render it probable that the benefit shall not be limited exclusively to the particular colony, but shall be largely participated in by the country from which the useful impulse shall have been imparted.

To this end, certain well understood precautions are indispensable. The extremes of extravagance and parsimony will be found alike injurious. The difficulty of maintaining a middle course is at all times much increased by the injudicious zeal and misplaced earnestness of the several advocates of their respective plans. An English Railway Engineer, unacquainted with the construction of similar works in America, will too frequently disregard the really economical features of the foreign work; while an American, imbued with the undeniable benefits which have attended the cheap, light, and rough works of his own country, will scarcely give the consideration, or attach the weight which is undoubtedly due to the stability and permanent character of the English system of construction.

Under the recently adopted practice of appropriating surplus profits to re-construction, the Boston, Lowell, and Concord Railway Company have completed a second line of rails of a more permanent description, and without interruption to the traffic. As a single line, it realised 12½ per cent. to the stockholders, of which, 8 per cent. was divided, and 4½ per cent. set aside to accumulate for this purpose.

The Railways of Massachussets, in the United States, exceed 1,000 miles, or one-sixth of all the American lines. From the last annual report of that State, in March, 1849, it appears that 28 lines of 1,002 miles (220 double, 782 single), cost 44 millions of dollars, about 9 millions sterling, averaging 43,781 dollars, or under £9,000 per mile,—that the speeds average 23·13 miles per hour for passengers, and 12·35 miles for goods —that the working expenses are 54 per cent. of the returns, and that the dividends upon the 13 principal lines average 7·283 per cent.

The form of returns used throughout this state, is added at the end of the work.

The ingenuity of the engineering world at large has been unceasingly directed for several years to the solution of that problem, which should constitute the ground work of our Colonial Railway practice, viz., the attainment in the construction, of a stability, which shall be at the same time the most economical and the most permanent; neither building too strong, at a prejudicial cost of interest for plant, nor refining too closely to the increase of current repairs and cost of maintenance.

It is not unreasonable to assume, that in each country the results of this steady direction of especial talent upon one common object, should have produced its fruits; and it is no less certain, that in our Colonies and in India there exist many points of strict analogy with the practice both of Europe and America, the observance or disregard of which, with the judgment exercised in their suitable adaptation to the particular exigencies of the case, will constitute at the same time one of the most difficult and important duties of those who are engaged in these works.

Past experience is to be regarded as a warning beacon.

No justification can be admitted for future errors. No plea will be recognized for experimentalizing. Sufficient precedents exist for all possible emergencies in the collective operations of the various states of Europe and America.

It is to be regretted that among the numerous and able publications which have issued from the press, at home and abroad, there should be no one devoted to the particular purposes of comparative Railway engineering, from which the several objects to be accomplished being shewn, the means adopted under the varying circumstances should be given, by which the comparative sufficiency or defects, the excessive or inadequate strengths and proportions of the means to the end, and the relative expenses of the several systems should be so accurately ascertained, as to afford sure and unerring data for future guidance.

Such a desideratum it is intended, in the following numbers of this little work, to initiate upon the limited and unpretending scale which of necessity characterises an elementary and popular production, in the hope and expectation that it may induce those who are so well able to accomplish the object fully and effectually, to consider the subject not undeserving their attention; and that a portion of that time which, among Railway engineers especially, has for so long been exclusively devoted to the designing and construction of those splendid monuments of science, talent, perseverance, and public spirit, may be occasionally applied to the elucidation of principles, the illustration of practice, and the comparative merits and demerits, advantages or disadvantages over similar works, with a view to the establishment of fixed, well-founded, and clearly demonstrated principles.

With these few remarks, we may proceed at once to the consideration of the statistics of English and Foreign Railways, under their several subdivisions of;—I. Constructive.—II. Operative.—III. Political.—IV. Commercial.—And, V. Social.

I. *Constructive.*—The construction of a Railway embraces the survey, selection, and levelling of the line (fully explained in the *Treatise on Levelling*), the drainage, and embankments or cuttings, the bridges, culverts, viaducts, and tunnels,—the stations, with their apparatus of cranes, pumps, turn tables, &c.—and the permanent way, which includes ballasting, sleepers, rails, chairs, keys, bolts, &c.

The Parliamentary expenses, law charges, and land, no longer occupy their unduly prominent position in the items of expenditure; and the cost of Railways may now be fairly estimated, and proportioned to the character and class of line required.

To obtain Parliamentary sanction to an English Railway, certain stipulations are required to be scrupulously observed;—the direction and precise length of the line to be shewn;—the points of junction with others;—the properties passed through and affected;—and a uniform scale to be adhered to. The limits of deviation on the plans are 100 yards on each side of the line, and 5 feet in the sections, except in passing towns, where 2 feet only are allowed, and the radius of curvatures is limited to 1 mile.

Due provision will be made by the engineer for the quality of materials, workmanship, proportions, and form of laying, and on all points upon which it is indispensable that the contractors should be bound in their contracts.

The practical operations of ranging, staking, and nicking out the centre line; of setting out and testing the curves, and of adapting them to the various circumstances and obstructions which continually arise; the fixing the level pegs and permanent posts, taking the cross sections, plotting the working sections to scales (usually of 3 chains horizontal, and 50 feet vertical, to an inch), ascertaining quantities, the setting out the slopes and widths, the foundations and works generally, as well as full particulars of the tools and instruments employed, are treated at length in the various publications devoted to the more detailed illustration of the subject.

Boring, with a description of the most useful tools, will form the subject of a separate work.

The Fencing may be of brick wall; of rubble, with dressed coping; of posts, rails, fences, and ditches; or of growing and impervious hedges;—the ditches proportioned to the quantities of water to be carried off, and discharged into the nearest water-course;—the gradients, curves, and slopes of each work, determined according to local circumstances and the materials employed.

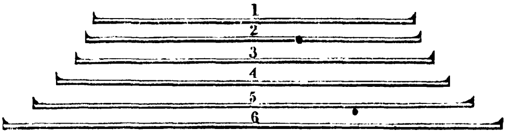
The average proportions of Materials required for a Trunk Line, of double way, per mile, may be estimated at:—Earth works, 100,000 cubic yards. Ballasting, 30 feet wide, 24 inches thick, 11,740 cubic yards. Sleepers, 3,520, 5 cubic feet each, 350 loads. Chairs, joints, 42lbs., 1,410, 26 tons. Chairs, intermediate, 28lbs., 5,640, 70 tons. Rails, 84lbs. per yard, 264 tons. Wedges, compressed elm, 7,050. Bolts, or compressed treenails, 14,100. Fencing, if not of quick or shrubs, 120 loads.

Masonry—Bridges, 2¼ per mile. Culverts, 176 per mile. Stations, one every 5 miles.

The relative proportions of charges for cost of Railway works were roughly estimated in 1840, as land, 10 per cent.; stations and carrying establishment, 20 per cent.; management, 10 per cent.; iron, 10 per cent.; works of construction, 50 per cent.; and the total expenditure at 3s. per mile, per train; of which the locomotive charges were 1s. 6d.; depreciation and interest, 6d.; carriage charges, 4d.; duty, salaries, management, establishment and maintenance, 8d.

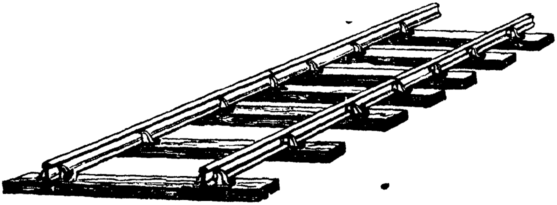
A table is in course of preparation, and will be given in the second portion of the work, to shew the comparative average value of labour and materials in different countries and districts, as affording an index to the occasion of the past, and probable future cost of public works generally.

The essential points of difference in the principles of construction may be defined as a varying guage, ranging from 4 feet 8½ inches to 7 feet, as under:—

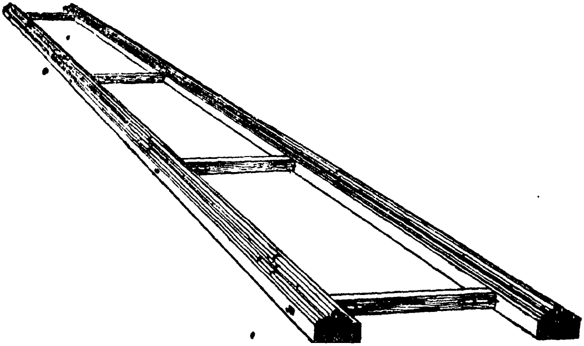


No. 1.—4 feet 6 inches, originally laid down in Scotland. No. 2.—4 feet 8½ inches, the gauge in most general use. No. 3—of 5 feet, formerly adopted for the Eastern Counties and Blackwall lines. No. 4—of 5 feet 6 inches, used in Scotland. No. 5.—The Irish gauge of 6 feet 2 inches; and No. 6, the Great Western of 7 feet gauge.

And the adoption of transverse sleepers and intermittent supports, at unequal intervals, with edge rails, or continuous longitudinal bearings, with a bridge rail, as shewn on the annexed sketches.

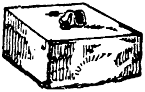


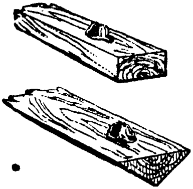
Edge Rail, with transverse Sleepers.



Bridge Rail, with longitudinal bearings.

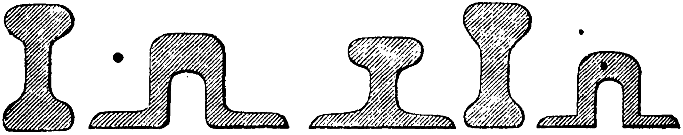
The forms of rails, chairs, modes of fastening, section of sleepers, combined chairs and sleepers, of cast and wrought iron, the use of hollow iron or compressed wood wedges, the turn table, switch, water crane, and other parts of the work, admit of great variety and modification, and have each their advocates and claims to superior advantages. They are rather deviations of detail than questions of principle. The annexed diagrams illustrate several of the plans in operation.





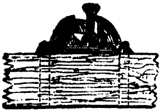
The sleepers, as shewn above, are of stone, in blocks of about 4 cubic feet, or of timber, squared, or cut diagonally with a triangular section, or half-round, as in the the case of larch and other descriptions of trees, of which the trunk is cut in lengths of 9 and 10 feet and divided.

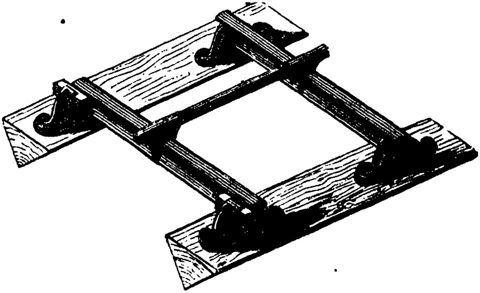
Of rails, the following are the most approved sections.



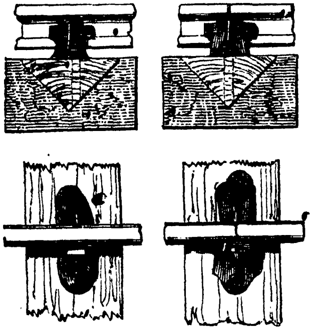
The first and fourth are the 72lb. and 84lb. rails of the London and North Western Company. The second and fifth, the best forms of bridge rail, and the third shews the most approved section of foot rail in use.

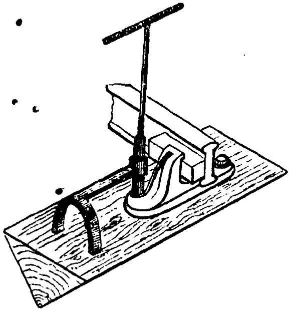
The form of cast-iron chair in most general use (Ransome and May's patent), with the compressed wooden wedge and trenails, and the adjusting gauge, are shewn in the annexed sketches.





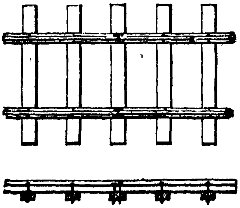
The following cuts shew the mode of fixing and the proportions of the joint and intermediate chairs, with the instruments used for boring the trenail holes with accuracy and despatch.

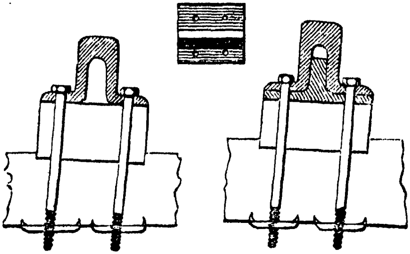




Upon this subject, the recent report of Mr. Dockray, respecting the relaying of the London and North Western line, deserves especial consideration.

The substance of this really valuable document is the strong recommendation to adopt, in the renewal of the permanent way, a principle, which will be understood by reference to the annexed sketches, as in Mr. Dockray's opinion combining the advantages and avoiding the defects which in greater or less degree attach to the works upon all the other lines he had examined.





The plan and elevation shew the general arrangement. The three enlarged sketches shew the bridge-rail, bolted at the joints and on the intermediate cross sleepers, with the wrought-iron shoe used where the rails meet. The longitudinal bearing, the secure mode of fastening, and the means by which the uniform inclination or cant of the rails is obtained, are clearly indicated.

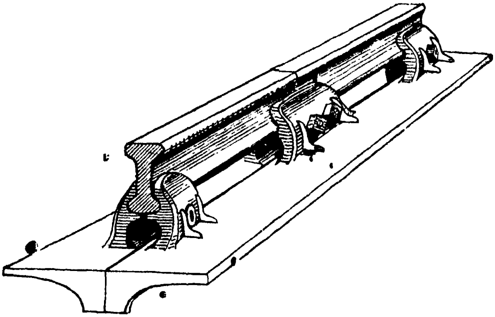
Under this arrangement, the number of parts in a mile of single line, which on the Great Western amounts to 28,512, and on the London and North Western to 17,248, will be reduced to 13,376, the cost being respectively £6 15*s.*, £6 5*s.*, and £7 5*s.* per length of 15 feet, when the price of rails was £10 per ton.

This principle of construction may be regarded as one of the most perfect yet devised, wherever the free use of timber is admissable. Economical considerations have for the present deferred its adoption on the London and North Western line, on which the 84lb. double-headed rail, with cast-iron chairs and compressed wedges, as shewn in former sketches, have been continued.

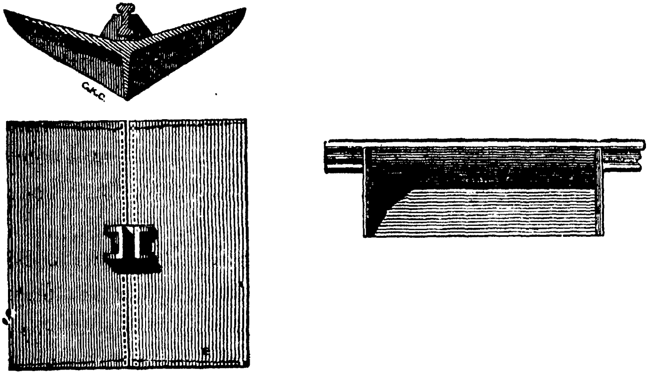
Among the numerous inventions which have been tried for the improvement and for the greater economy of construction and maintenance of the permanent way, a few may be mentioned as possessing a sufficient degree of novelty in principle and practical character to justify their enumeration.

The cast-iron combined sleeper and chair of Mr. Barlow, which has been laid down on the South

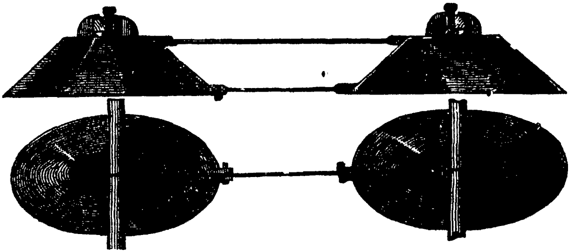
Eastern line, will be understood from the following sketch:—



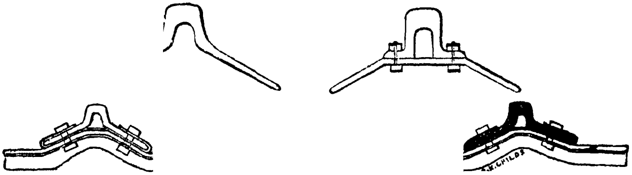
Mr. W. Brunton's combined cast-iron chair and sleeper is shewn in the annexed sketch:—



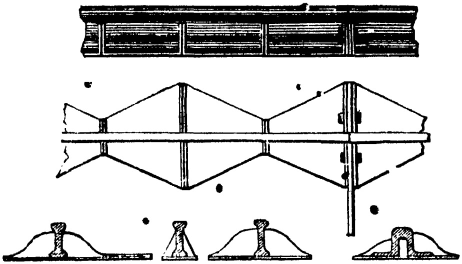
Mr. Greave's patent combined cast-iron hollow sleeper or block and chair, in a single casting, the rails being keyed up in the usual manner, and the gauge of rail preserved by ties to each set of sleepers, as shewn in the annexed sketch:—



Mr. W. H. Barlow's patent, as shewn below, in which the increased width of the rail is made available as a bearing for its support;—at the joints, a wrought-iron plate or shoe is bolted to the rails, and the ties are of broad wrought-iron.

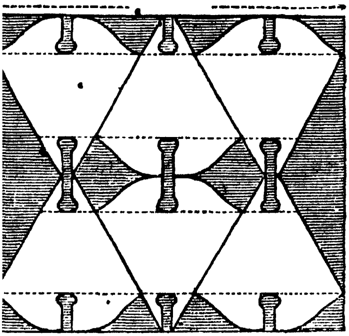


Another mode of construction is that of Mr. Macdonald Stephenson's, to provide against the contingency of its being found impossible to preserve and protect the wood sleepers in tropical climates. The diagram shews the arrangement by which a continuous bearing is obtained with any form of rail, and without the use of wood at all. No wedges or bolts are required, except at the joints, and no cast-iron is made use of. The principle consists in the previous preparation, by shaping, punching, and bending wrought-iron boiler plate, of about ½ or ⅝ thickness. The ends are turned up and abut one against the other, the rail being inserted into the opening punched out of the plates to receive it, and forming a clip which effectually secures the rail under all circumstances.

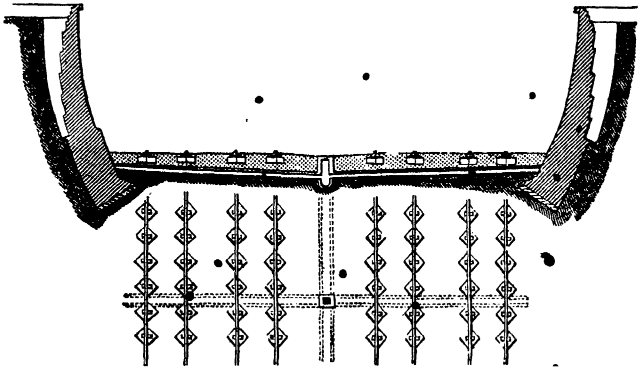


At the joints is inserted a cheek of 1 inch plate, similarly punched to receive the rail, and bolted to the ends of the bent plates. The cheek is tapered to form the connecting rod between the two rails.

The annexed rough sketch will shew the mode of preparing the plates, the dark part being cut away, and the ends bent up at right angles.

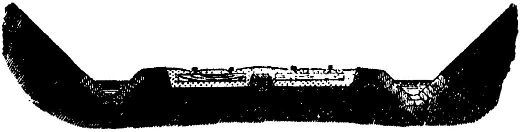


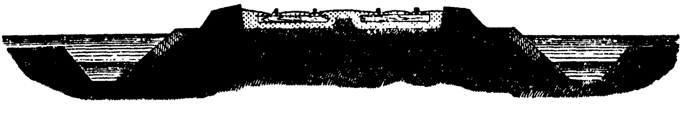
The several forms of construction and station apparatus are shewn in the following sketches.



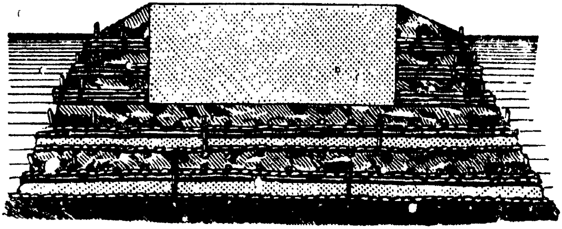
The above section and plan shew a line in cutting, with retaining walls, the longitudinal and cross drains, and stone blocks, which have given place very generally to wood sleepers, the elasticity of which, as compared with the rigidity of the stone, tends to materially diminish the cost of maintenance of way, and current repairs.

The two following sections represent a cutting and embankment, with provisions for drainage, and the preservation of the banks by pitching. Wood sleepers are shewn in both sections, and on the latter, the line is assumed to be laid in a district subject to inundation. and to be occasionally under water.



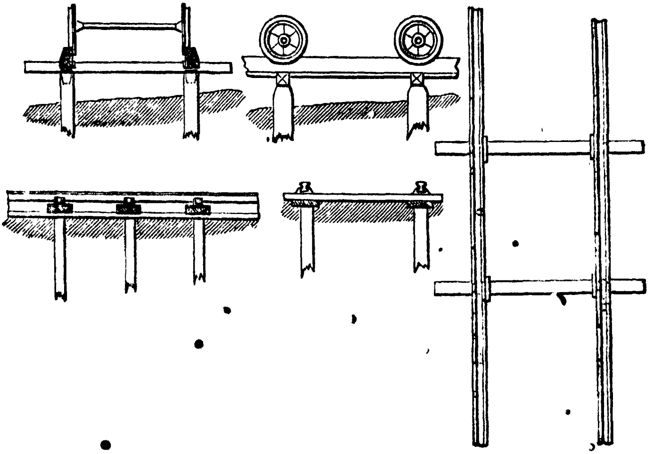


The annexed section is taken from one of the lines in Holland, which passes through wet and marshy land, and is formed of fascines and stakes bound together, and laid alternately across and longitudinally.

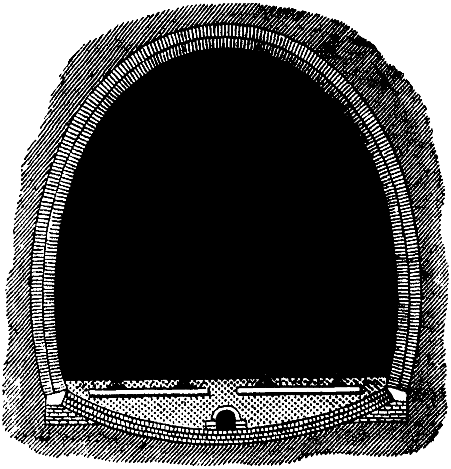


The pile lines which have been constructed in parts of the South American States, where circumstances have induced their adoption, are shewn in the following sketches.

They are only applicable where the loads are light, timber abundant, and where the usual mode of construction is attended with especial difficulty. The objection to their subsidence will be removed by the use of the screw pile elsewhere referred to. They are composed of a series of piles, securely connected by cross timbers, and a longitudinal framing, on which a plain bar of iron, or a light rail and chair are laid. When the piles rise much above the ground level, diagonal braces require to be introduced.



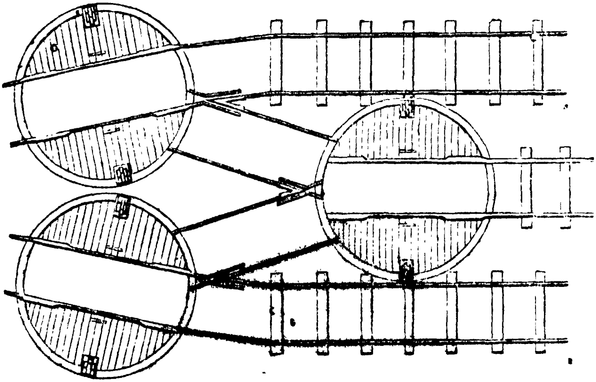
The following is a sketch of a line laid in a tunnel on wood sleepers, shewing the drainage.



The operation of diverting, by means of turntables, an engine, carriage, or waggon from one to another line of rails, will be readily understood by reference to the following sketch.

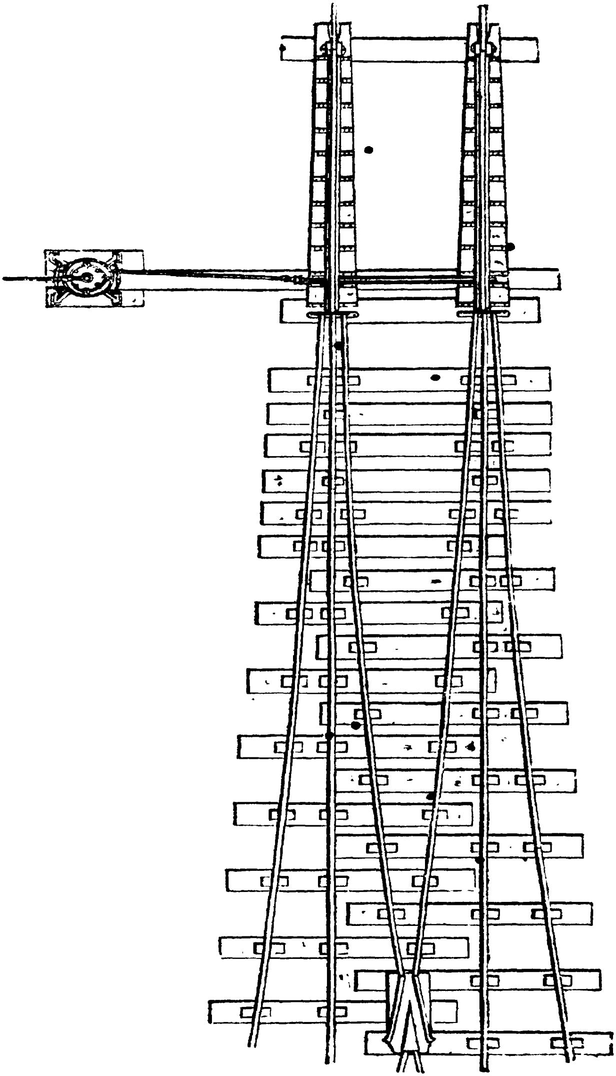
The turntables in general use are of cast-iron, with wrought-iron ties, bolts, and revolving gearing; they are occasionally made of wood and iron, as well as of wrought-iron exclusively.

The principle of construction by which they were made to revolve on a centre, has been entirely set aside, as entailing increased cost for the foundations, and the original plans are now uniformly adhered to.

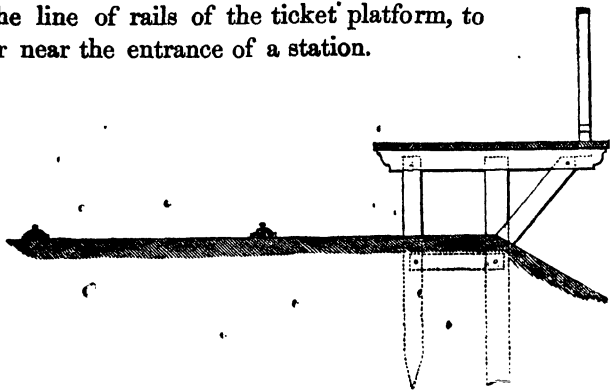


The following sketch of the apparatus by which an entire train is turned from one into another line of rails, will explain the operation. The single line of rails is shifted by the switch (shewn at the side) to either of the three diverging lines.

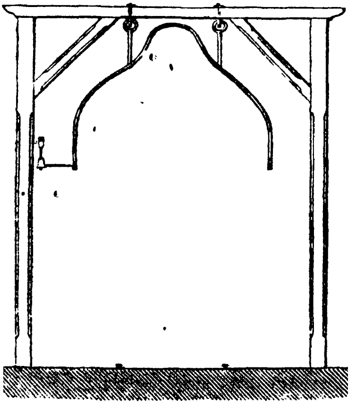
The improved switches in most general use are those of Wild and Fox.



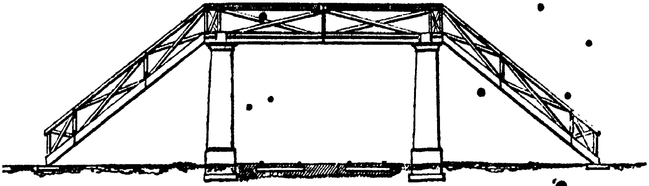
The following sketch shews the position in relation to the line of rails of the ticket platform, to or near the entrance of a station.



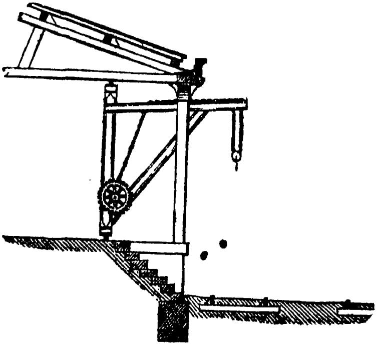
The simplicity of the means employed to prevent the loading of waggons exceeding the limits allowed for passing through tunnels and under bridges, will be understood by the annexed sketch of a frame, with a bell attached to it, under which the loaded waggons readily pass, so long as their loading does not exceed the prescribed limits.



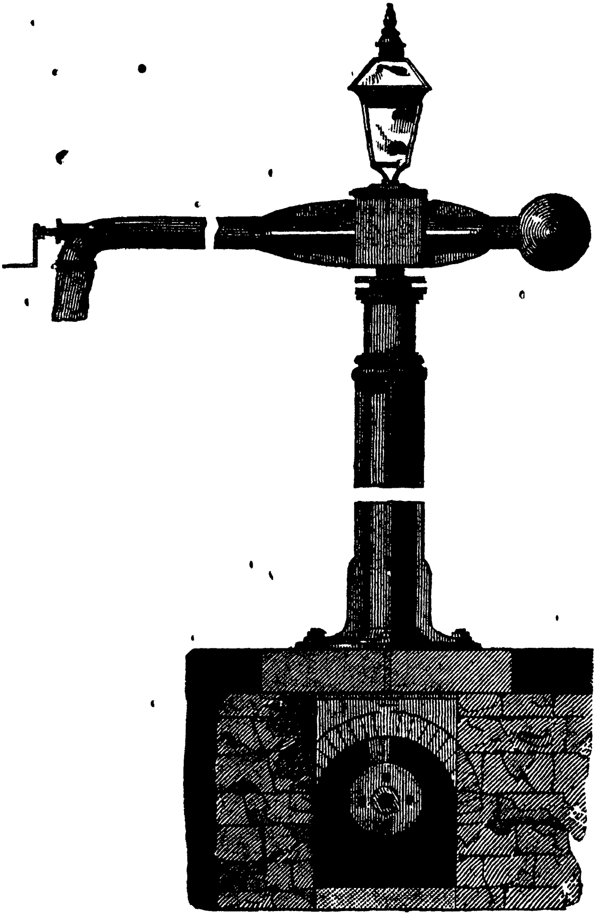
The following sketch shews the mode of keeping open the communication for foot passengers between the two sides of a line of Railway, without crossing on the level.



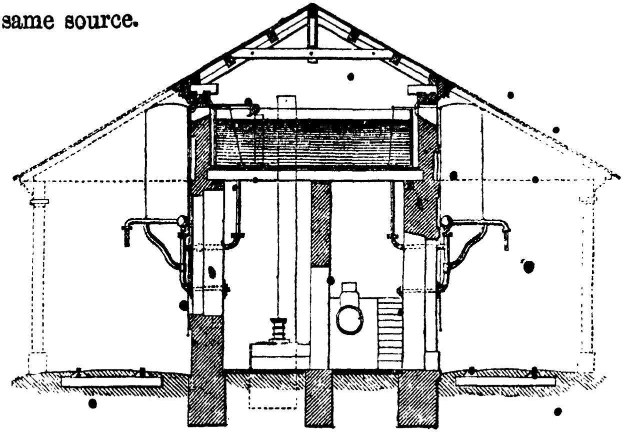
The following is a sketch of the goods' crane, shewing its position in relation to the Railway, and the facilities afforded for loading and discharging the waggons.



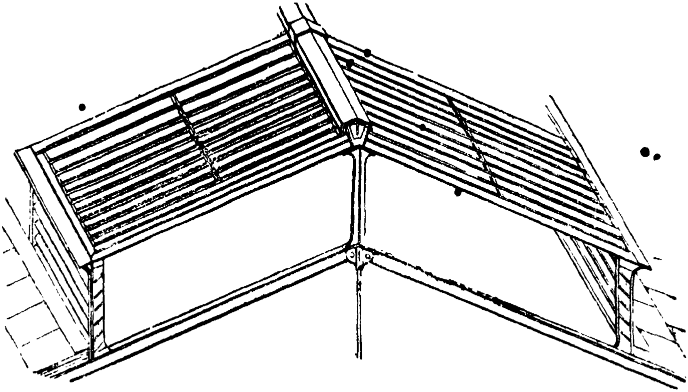
The annexed sketch shews, on an enlarged scale, a description of water crane in very general use, but which is neither so simple nor economical a form as is shewn in the smaller diagram in which the water is contained in a cistern above the crane.

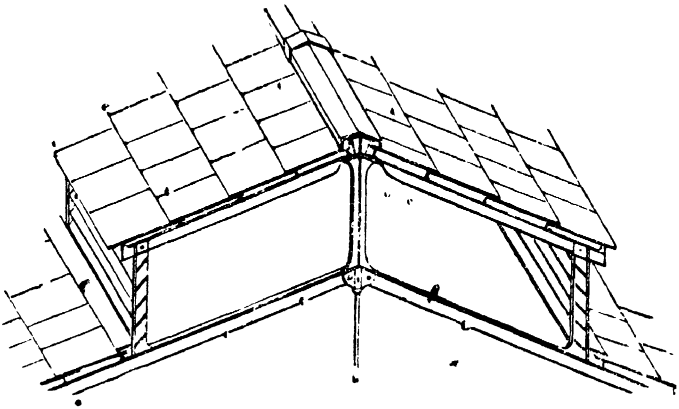


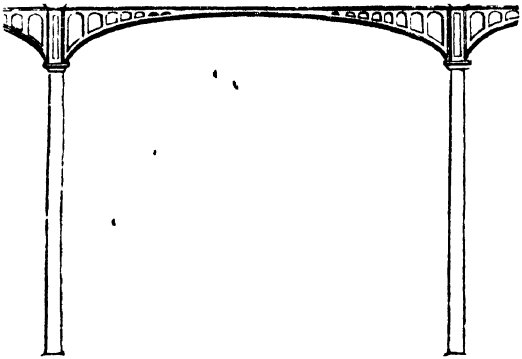
In the annexed sketch, the water cistern is placed above the cranes, two of which are supplied from the same source.

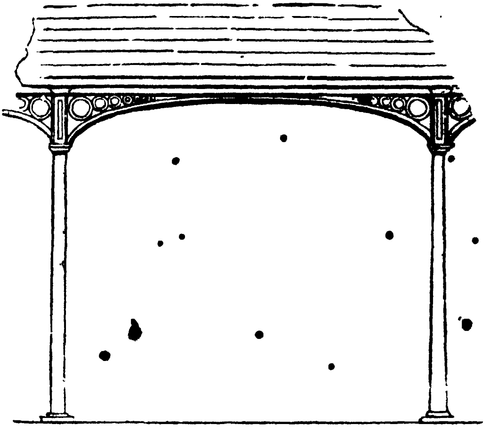


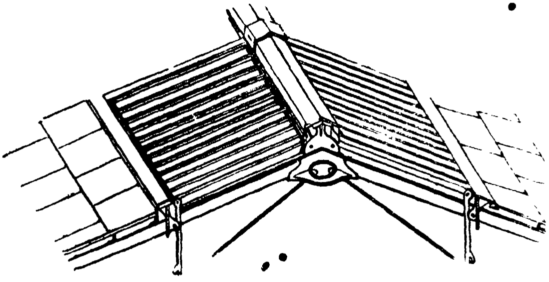
The following are enlarged scale sketches of roofs of various descriptions, recently erected by Messrs. Fox, Henderson & Co., and the general appearance will be seen by reference to the perspective sketch which follows.

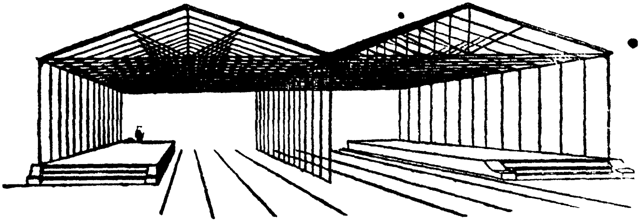




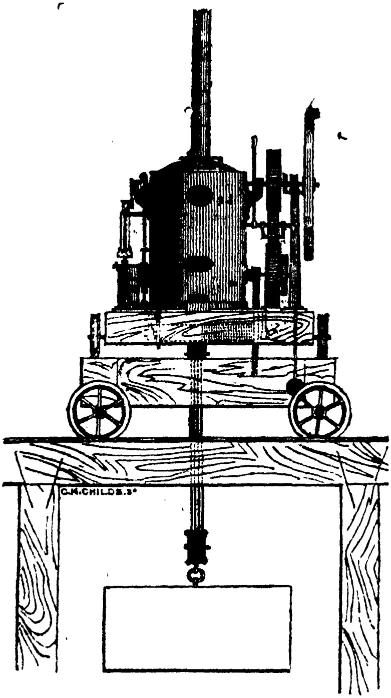




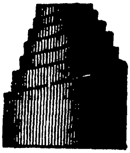


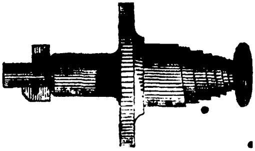


One of the most valuable auxiliaries of a Railway contractor, is the portable engine, of which there are two forms in most general use, vertical and horizontal,—the former of which is shewn on the annexed sketch. Its application to all the varying purposes of contractor's work, will be readily understood from its lightness, economy, and portability. It is here shewn upon a traversing platform raising the materials for a building.



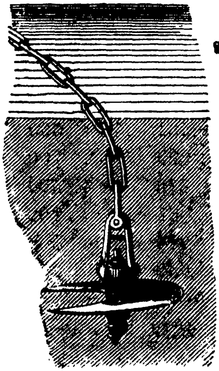
The simplicity and cheapness of what are known as the Volute Springs, entitle them to consideration now that they have been in use, both in England and on the continent, for a sufficient period to attest their practical utility. The annexed diagrams will explain their construction:—

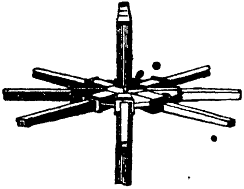


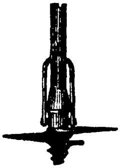


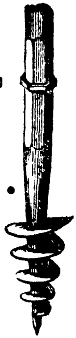
The screw pile, already referred to, is one of the most simple, economical, and effective contrivances of this pre-eminently mechanical age. The principle will be understood from the following sketches, of which the smaller figure shews the description of screw used for signal, mile, or telegraph posts: the larger screw is applied to the more substantial purposes of foundation piles; and the mooring screw is shewn in the process of fixing, and, as it afterwards remains firmly embedded in the sand or silt of a river or harbour.

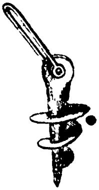
The form and proportions of the screw, as well as the mode of fixing, have been varied according to the views of different engineers, but the principle is the same, and its practical value is undisputed.











One of the most recent suggestions for Railway carriage wheels, is the use of solid wrought iron for tyres, nave, and the interval usually occupied by the spokes, the entire wheel being rolled, hammered, and shaped out of the solid. The weight is expected to be less than that of the wheels in use, and the price the same. It is referred to only as a novelty about to be tested, and not as a *fait accompli*, to be yet regarded as anything beyond an experiment.

The subjoined analysis of the cost of the several items of expenditure upon the Taunus Railway, is extracted from Mr. Thorman's interesting account of that work, and will give an insight into the comparative outlay for the construction of a Continental or Colonial Line (not being a trunk), of moderate average cost.

Taunus Railway.— 26 Miles. Francfort to Weisbaden. Guage 4ft. 8½in. Bridges, &c., for double line. Single rails only laid. Rails 58lbs., cost delivered £16 per ton. Sleepers, 12 inch to 16 inch, 3*s.* 4*d.* each. Blocks, 24 × 24 × 12, 4*s.* 2*d.* each. Average, six through trains daily each way.

	Cost of Taunus, £ per mile.	Assume for a Colonial Line of 50 to 100 miles of average work.
Surveying, Engineering, &c.	561	600
Earth Works	669	700
Bridges and Culverts	436	500
Walling	67	100
Ballast	214	300
Blocks and Sleepers	650	700
	2597	2900

	Cost of Taunus, £ per mile.	Assume for a Colonial Line of 50 to 100 miles of average work.
Brought forward	2597	2900
Rails	1897	1900*
Chairs	449	500
Nails, Keys and Dowells	78	100
Felt for Chairs	8	
Laying Rails, Chairs, &c.	142	200
Twenty-five Switches, Crossings and Points	41	100
Turnpike and Cross Roads	54	100
Fencing, Posts, Warning Tables	114	200
Turn Tables, 16 large 13 small	136	200
Stations and Watchhouses	1019	1100
Boundary stones	4	100
Extra expenses, at	42	
Water tanks, cranes, pumps, &c.	25	100
Work not previously included	21	
	6627	7500
Deduct materials not used, &c.	169	1300
	6456	6200
Land (usually granted free of cost)	2088	0
Six locomotives, tenders, and duplicate parts	559	650
Eighty-seven carriages, 21 trucks	813	900
Expenses of administration	179	200
Workshops, tools, &c.	76	100
Electric telegraph	11	50
	10182	8100

* Will be 2,500 at £16, but at £8, and 84lbs. Bridge rail.
132 tons or 1056
Spikes, &c. 144
——1200

A list of the contractor's plant will not inappropriately terminate and complete the constructive view of the subject, and is estimated for a line of moderate length, and with an average character of works.

Memorandum of Contractor's Plant required for a Colonial Line of from 50 *to* 100 *Miles, at an estimated cost of from* £5,000 *to* £15,000.

10	Iron wedges, assorted.
100	Crowbars, steeled at both ends.
50	Best steel borers, 18 inches.
5	Double pumps.
25	Single pumps.
50	Sledge hammers.
100	Hand hammers, wedge and adjusting.
10	Crabs, 5 single, 5 double.
10	Sets of metal blocks and hemp falls, assorted.
10	Patent screw jacks.
4	Travelling hoisting machines.
50	Picks, light pattern, mattocks.
50	Shovels, ditto.
10	Sets of boring tackle.
4	Portable engines.
10	Portable smith's forges.
10	Barrows.
100	Sets of iron work for ditto.
5	Earth waggons.
100	Sets of wheels and axles, and iron work for ditto.
200	Tons of contractor's bridge rails.
10	Sets of carpenter's tools.
100	Pile screws, (Mitchell's patent.)
1	Set of stone quarrying tools, as per list.*
1	Sleeper cutting and shaping machine.
2	Sets of saw mill apparatus and gearing.
1	Wood preserving apparatus, tank, hydraulic press, &c., complete.
3	Sets of assorted circular saws, bands, and gearing.
2	Grindstones.
10	Tons assorted chain, slings, &c.
3	Tons assorted bolts, spikes, and wood screws.
3	Locomotive engines.

3 Sets of spare parts of engines.
4 Brick machines.
100 Sets of bricklayer's and mason's tools.
20 Tons assorted flat, square, and round iron.
1 Ton assorted steel.
2 Lathes.
Coke
Pug, Mortar, and Cement Mills.
Rammers, levels, chisels, squares, iron chasers, adjusting mallets, anvils (rail dressing), levers for raising rails, guages for adjusting chairs.

Hand instruments obtained on the spot, of form, size, and weight in general use.

The Cost of a Set of the following Tools required by One Gang of Layers is about £7 to £10.

1 Wood hammer, iron-bound.
1 Set of levels, viz., 2 red, 2 black, and 1 white.
4 Pickets, shod to receive levels.
2 Wooden rules.
1 Wooden lever, shod.
1 Claw crow bar for dressing rails, about 90lbs.
1 Crow bar for dressing way, 44lbs.
1 Iron hammer for keying, 9lbs.
1 Iron gauge for setting out width of way.
1 Hand hammer.
1 Auger.
1 Tool marker.

**Estimate of Tools required for the Opening of a Stone Quarry.*

20 1⅝in. drawing round prime bars, 5 feet long.; 10 2in. ditto ditto, 7 feet long; 4 3in. ditto ditto, 12 feet long. 150 Wedges, averaging 5lbs. each wedge. 12 Hammers, 6 14lbs. and 6 16lbs. each. 20 Picks, 10lbs. each, to clear top of stone. 20 Stone-cutter's picks, 14lbs. each. 200 Boring drills for blasting, 6lbs. each. 4 Pairs of stone nippers. 20 Pairs of lewises. 20 Sling chains of various lengths and sizes. 50 Shovels. 6 Crabs for hoisting. 4 Pairs of large blocks for hoisting. 2 Smith's forges,

complete. 1 Ton of merchant iron. 5 Cwt. of blister steel. 2 Derricks for hoisting. Ghuy and hoisting chains.

Granite Stone Quarry.—The above tools are sufficient for 110 men, divided in gangs of 11 men, each gang consisting of 10 quarry men and 1 stone-cutter, and, if properly managed, will get 5,000 cubic feet of stone quarried to given dimensions per week.

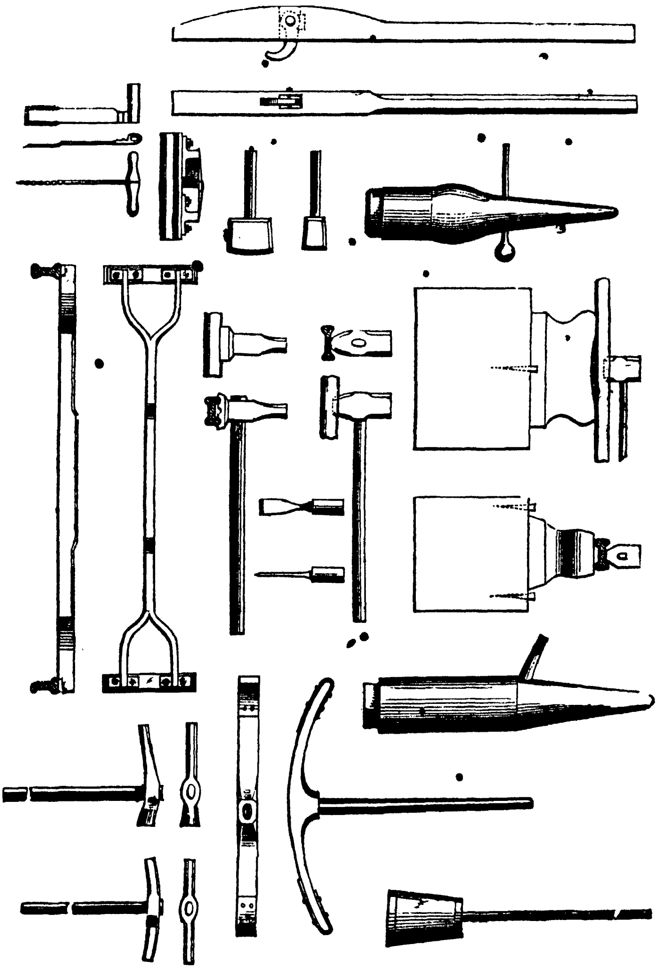
Sand Stone Quarry.—The above number of men will get 7,000 cubic feet per week.

Mason.—One mason's kit is 20lbs., weight of cast steel chisels, and 1 mallet.

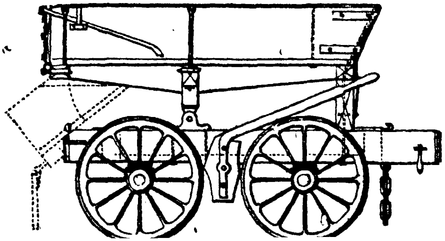
The practice of executing Railway work by contract is so general, and so well understood, in England, that it would be unnecessary to refer to the subject, but in Colonial works the rule is not of invariable application. In frequent instances it will be more advantageous that the early operations should not be entrusted to a contractor, inasmuch, as from the novel character of the works, no local contractor would be found possessed of the requisite experience. The remark applies equally in the case of English contractors undertaking the work, unless they shall have had the opportunity of becoming previously acquainted with local practices and prices. When, however, the interests of a Company and of a contractor can be identified, the principle of contract work is invariably to be preferred.

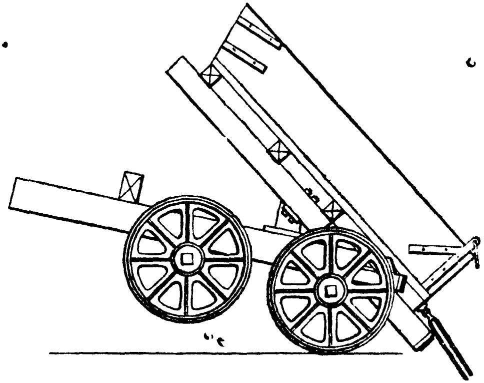
The establishment, at the outset of a great work, of an average scale of prices for labour and materials, founded on past experience, and varying only to the extent due to local circumstances, is of the utmost importance, as affording a criterion or test by which to estimate future charges. The adventitious increase in prices usually consequent upon a new source of demand will, unless carefully provided against, so materially affect the aggregate cost of such a work as a Railway, as to justify especial reference to its early and attentive consideration.

The annexed plate will shew the description of tools employed in laying the line.



One of the cheapest and most useful descriptions of contractor's earth waggon is shewn in the annexed sketches.





A list of stores required in working, taken from the list recently issued by the London and North Western Railway Company, will furnish the most authentic data on the subject, and will be found at the end of the work in their order and classification.

For Colonial Railways, the iron work alone will be required to be supplied from England for all except the sample carriages and waggons.

The following are the particulars of this portion of the necessary supplies.

The weights and cost of the iron work are omitted, as they will vary with the description and dimensions of the carriages and waggons in use. The articles required are buffer necks, draw rods, corner plates, knee plates, tie rods, scroll irons, axle guards, buffer rods, screw bolts, screw couplings, safety chains, grease covers, steps, lamp protectors, bolts and nuts, screws and nails, punched hoop iron, panels of iron and papier mâché, angle iron, double angle or T iron, springs, the small iron and brass work and furniture for the interior of the carriages, and the wheels and axles.

2. *Operative.*—The working stock of a Railway may be estimated as under, for a line of from 50 to 100 miles, for early operations and with an average traffic:—

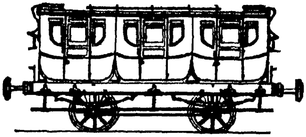
No.	Description.	Weight.	Rate.	Total Cost.
		To	£	£
16	Locomotive Engines and Tenders, empty	18 7	2,200	35,200
50	1st Class Carriages	3¼	300	15,000
50	2nd ,, ,,	3	220	11,000
100	3rd ,, ,,	3¼	200	20,000
2	Specially constructed Carriages, of a Class recently introduced, 1st and Second Class combined.	4	600	1,200
50	Spacious Carriages, 4th Class, without seats, separated by railing	3½	200	10,000
5	Post-office Carriages and Tenders	6	200	1,000
25	Trucks	3	120	3,000
10	Horse boxes	3½	120	1,200
250	Goods waggons	2½	100	25,000
5	Cattle and sheep cages	3	100	500
100	Iron hopper coal waggons	2	70	7,000
10	Luggage vans	3	80	800
				£143,400

A light description of engine and carriage combined has been recently used on some of the lines, and is well adapted for branches or light traffic. The total cost is £1,800. Accommodating 20 first class and 96 second class passengers, by the use of bow springs, with double movement, it can traverse curves of 5 chains radius, running on 8 wheels, and travels with this load at 30 miles an hour, with a consumption of 10 lbs. of coke per mile. Of the £1,800, the small engine costs £1,230, the carriage, £570. A smaller description of engine and carriage, to convey 24 first class passengers only, will cost about £1,000.

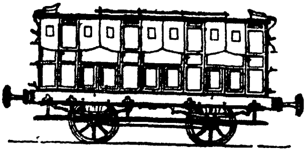
In the construction of the passenger carriages, one especial object should be kept in view. The proportion of the paying to the dead weight in passenger trains is susceptible of material modification, and consequent economy.

The travelling public, as a body, would not complain of a diminution in the luxurious accommodation afforded, by which the charges were sensibly reduced; and it is manifest, that if, in lieu of six persons occupying one carriage, eight can in the same space be conveniently provided for, the charges upon the larger number might, without loss to the Company, be reduced by from 20 to 30 per cent.

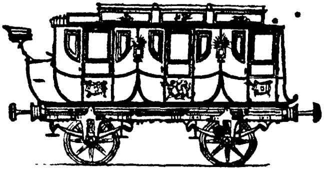
The annexed sketches of working stock consist of first and second class and mail carriages, luggage van, cattle and goods waggons, coal waggon, and timber carriage; the designs, dimensions, weights, and cost varying upon different lines.



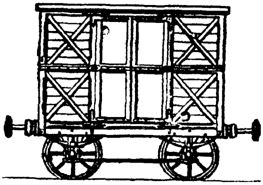
First Class Carriage.



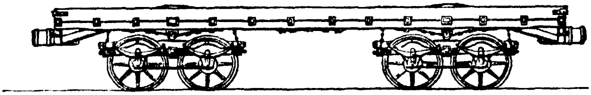
Second Class Carriage.



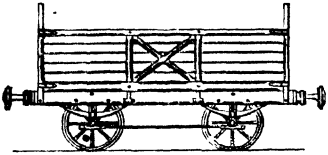
Express or Mail Carriage.



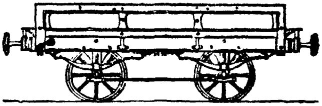
Luggage Van.



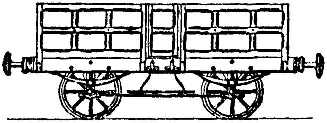
Timber Carriage.



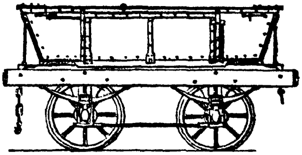
Goods Waggon.



Carriage Truck.



Third Class,
Open Passenger Carriage.



Coal Waggon.

The following descriptions of locomotive engines are recommended for the different purposes required, whether for ballasting, passengers, or goods engines.

Weight of Locomotive Engines and Tenders.

	Tons.	cwt.	qrs.	lbs.
Ballasting Engine— 13in. cylinders, 2ft. stroke 2 pair 4ft. 6in. wheels, coupled	13	10	0	0
Tender on 4 wheels, when full	9	2	0	0
when light	5	10	0	0
Passenger Engine— 15in. cylinder, 20in. stroke 1 pair driving wheels, 6ft. diameter 1 „ leading „ 4ft. 6in. „ 1 „ trailing „ 3ft. 9in. „	17	10	0	0
Tender on 6 wheels, full	11	15	0	0
light	7	0	0	0
Goods Engine— 16in. cylinders, 2ft. stroke 6 wheels, 5ft. diameter, all coupled	18	0	0	0
Tender on 6 wheels, full	12	0	0	0
light	7	5	0	0

The following memorandum shews the tools and machinery required for the locomotive repairing shops.

No. 1.—Steam Engine, Mill Gearing, Tools, &c., for a Locomotive Repairing Shop.

STEAM ENGINE AND MILL GEARING, CONSISTING OF

High pressure engine, 20-horse power.
2 Boilers.
Mountings.
Wrought and cast-iron shafting.
Couplings.
Keys, bolts, and nuts.
Bevel wheels, (morticed.)
Wall boxes, pedestals, brackets, &c.
Hangers.
Pullies.
Brasses.

GROUND FLOOR.

Lathe for turning up locomotive wheels, keyed on their axles.
Large lathe for general use.
4 Slide lathes, 14 inch head stocks, 18 feet. beds.
1 Screwing ditto ditto.
2 Double pillar drills, back geared.
2 Portable drills.
3 Wall drills, rising tables.
2 Nut shaping machines.
2 Large lever planing machines.
2 5-inch slotting machines.
Planing machines, 6 feet.
1 ditto 10 feet.
Slotting machine, 12in. stroke.
Ditto for slotting locomotive driving wheels, paring cranks, &c.
1 Horizontal boring machine, with two boring bars.
2 Large bolt screwing machines.
1 Punching machine.
1 Shearing machine.
2 Grindstones and frames.
1 Fan.
1 25-cwt. steam hammer, with anvil, &c., complete.
1 10-cwt. ditto ditto
2 Forge furnaces, and chimney mountings.
2 1-ton cranes.
2 Large smithy fires, anvils, and other tools for ditto.
12 Small ditto ditto
24 Vices for tilters, and 4 for smithy.
Cupola, with stage, staves, &c.
Iron-work for brass furnace.

SECOND FLOOR.

2 Slide lathes, 14 inch head stocks, 18 feet beds.
2 ditto 12 inch ditto ditto
1 Screwing lathe, 10 inch ditto ditto
1 Slide lathe, 10 inch ditto ditto
2 Pair of lathes, 10 inch ditto beds, and slide rests.

2 Small bolt screwing machines.
4 Small lever planing machines.
2 5 inch slotting machines.
4 Foot lathes.
2 Portable drills.
2 Circular saws, cast-iron beds, planed.
2 Grindstones and frames.
1 Crane to lift a ton.
2 Cranes to lift 2 tons each.

Cost of above from £10,000 to £15,000 delivered in London or Liverpool.

Estimate No. 2.

1 Patent slide lathe, 7 inch centres, 7 feet bed.
11 Extra change wheels, for screw cutting.
1 Universal four-screw chuck.

2 Patent slide lathes, 10 inch centres, 15 feet bed.
2 Self-acting apparatus for surfacing.
2 Sets of extra change wheels, for screw cutting.
2 Universal four-screw chucks.

1 Patent slide lathe, 12 inch centres, 12 feet bed.
13 Extra change wheels.
Self-acting apparatus for surfacing.
1 Universal four-screw chuck.

1 Patent slide lathe, 18 inch centres, 18 feet bed.
13 Extra change wheels.
1 Universal four-screw chuck.
1 Apparatus for fixing cylinders.
1 Self-acting boring bar, 6 inch diameter, 5 feet long.
1 Cast-iron ditto 6 inch ditto 6 feet ditto.

1 Patent slide, &c., break lathe, 21 inch centres, to take in 7 feet diameter; base plate 23 feet long, bed 10 feet.
13 Extra change wheels.

1 Turning lathe, 8½ inch centres, 9 feet bed.
1 Universal four-screw chuck.

1	Turning lathe, 10 inch centres, 10 feet bed.
1	Universal four-screw chuck.
1	Locomotive wheel turning and boring lathe for turning or boring locomotive wheels on their axle both at once.
2	Patent planing machines.
2	Sets of driving apparatus.
12	Sets of chucking apparatus.
4	Table chucks.
1	Patent planing machine, bed 16 feet long, to plane 12 feet 3½ feet × 3½ feet.
1	Driving apparatus.
6	Sets of chucking apparatus.
2	Table chucks.
1	Patent planing machine, bed 34 feet long, to plane 26 feet 4 feet × 4 feet.
1	Driving apparatus.
6	Sets of chucking apparatus.
2	Table chucks.
1	General shaping and planing machine.
1	Driving apparatus.
1	Patent vertical drilling and boring machine, No. 1, 15 inch centre, with extra table.
1	Driving apparatus.
1	Patent vertical drilling and boring machine, No. 2, 22 inch centre, with extra table.
1	Driving apparatus.
1	Large vertical drilling and boring machine, 32 inch centre, bed 6 feet long.
1	Driving apparatus.
1	Patent radial drilling and boring machine.
1	Driving apparatus.
1	Crank slotting machine.
1	Driving apparatus.
1	Crank slotting machine.
1	Driving apparatus.

1 Punching and shearing machine, No. 1.
1 Ditto ditto ditto No. 2.
1 Patent bolt screwing machine, self-acting reversing motion.
1 Ditto ditto ditto ditto
3 Pair of surface plates, viz., 9 inch × 6 inch, 12 inch × 8 inch, and 18 inch × 12 inch.
1 Set of circular gauges, from ⅛ inch to 2 inches.
1 Patent guide screw stock, complete.
1 Ditto ditto ditto
1 Ditto ditto ditto
1 Ditto ditto ditto
1 Ditto ditto ditto

Cost of the above, including engine power, delivered in London or Liverpool, from £5,000 to £9,000.

Having given the particulars of the stock and tools necessary for working the line, a brief reference to the staff of persons employed may be useful.

The Local Establishment, assuming the direction to be in England, of a Colonial Line of from 50 to 100 miles, may at the outset be limited to:—

1 An Executive Officer, with full powers and general charge of the entire operations.
1 Principal engineer, to superintend the constructive department.
1 Inspector in charge of stations and all buildings, the Railway and working stock.
1 Traffic manager, with management and control of traffic.
1 Secretary.
1 Cashier.
1 Bookkeeper and accountant.
1 Clerk of contracts, for purchase of materials, and for supplies of labour.
1 Measuring clerk of contract work
4 Assistants in office.
1 General storekeeper.
1 Telegraph clerk.

Engineering Department of Office.

1 Office engineer.
1 Principal draughtsman.
3 Assistant ditto

Principal Terminal Station.

1 Station manager.
1 Assistant.
3 Ticket clerks.
1 Bookkeeper.
1 Passenger train inspector.
1 Merchandize inspector.
6 Porters.
20 Men on miscellaneous duty.

At each Intermediate Station.

1 Station clerk.
1 Ticket clerk.
2 Porters.
4 Men.
1 Passenger and goods inspector.

With Trains.

Engine driver.
Stoker.
Guard.
2 Breaksmen.

On Way.

Under control of Inspector—

4 Overseers.
24 Assistants.
200 Plate-layers, police, and pointsmen.

Locomotive and Repairing Establishment.

1 Locomotive superintendent.
1 Foreman.
1 Assistant.
2 Clerks.
20 Drivers.
25 Stokers.
10 Cleaners.
1 Storekeeper.
5 Labourers.
100 Workmen.

In the following Tables the comparative Working Expenses are shewn of some of the principal Railways in the years 1844 and 1848.

Statement of Cost connected with Conveyance of Traffic, *(Belgium,* 1844.*)*

	Management and Superintendance.	Maintenance of Way.	Expense of Traction.		Expenses of Carriages.	Loading and Starting.	Sundry Expenses.	TOTALS.	
			Quick Trains.	Slow Trains.				Quick Trains.	Slow Trains.
First Class Passengers.—									
In Francs per myriametre (6.2138 miles)	.0322	.0722	.0796	.0492	.0286	.0117	.0254	.2497	.2193
In Pence per mile	.054	.12	.13	.082	.047	.02	.042	.41	.36
Second Class Passengers.—									
Francs per myriametre	.0217	.0488	.0538	.0333	.0193	.0174	.0038	.1648	.1443
Pence per mile	.036	.081	.09	.055	.032	.032	.006	.27	.24
Third Class Passengers.—									
Francs per myriametre	.0168	.0376	.0414	.0256	.0149	.0236	.0038	.1381	.1223
Pence per mile	.024	.062	.069	.042	.024	.04	.006	.23	.2
Tons of Baggage.—									
Francs per myriametre	.4883	1.0950	1.2075	.7465	.4165	1.4705	.0424	4.7202	4.2592
Pence per mile	.81	1.82	2.01	1.24	.69	2.45	.07	7.86	7.09
Tons of Light Goods.—									
Francs per myriametre	.1482	.3323	.3665	.2266	.1264	.6124	.0424	1.6282	1.4883
Pence per mile	.24	.55	.61	.37	.21	1.02	.07	2.71	2.48
Tons of Heavy Goods.—									
Francs per myriametre	.1119	.2509	.2767	.1690	.0802	.0843	.0424	.8464	.7383
Pence per mile	.189	.418	.461	.281	.133	.14	.07	1.41	1.23
Horses.—									
Francs per myriametre	.1646	.3692	.4071	.2517	.1404	.0083	.0297	1.1193	0.9639
Pence per mile	.241	.615	.68	.419	.23	.014	.049	.199	1.6
Cattle.—									
Francs per myriametre	.0658	.1475	.1626	.1006	.0474	.0101	.0191	.4525	.3905
Pence per mile	.109	.245	.271	.16	.079	.05	.031	.75	.65
Sheep—									
Francs per myriametre	.0079	.0177	.0195	.0120	.0057	.0030	.0042	.0580	.0505
Pence per mile	.013	.03	.032	.02	.0095	.005	.007	.096	.084
Carriages.—									
Francs per myriametre	.3715	.8331	.9186	.5680	.2664	.1112	.0424	2.5432	2.1926
Pence per mile	.619	1.388	1.531	.946	.414	.185	.07	4.23	3.65

The annexed Table of comparative Working Expenses upon Twelve Railways for the half-year ending 31*st Dec.*, 1848, *is compiled from a valuable Paper, published by* MR. J. S. YEATS, *in March*, 1849.

	Length Miles.	1 Maintenance of Way.		2 Locomotive Charges.		3 Coaching, Merchandize, and General Charges.		TOTAL per Centage of Working Expenses to Returns.
		£ per mile.	per cent.	£ per mile.	per cent.	£ per cent.	per cent.	
London and North Western ...	435	100	3.9	293	11.3	485	18.8	34.
Great Western....................	306	134	7.7	174	10.1	292	16.7	34.5
Lancashire and Yorkshire	172½	69	4.5	165	10.8	291	18.9	34.2
Midland............................	463½	58	4.4	196	14.8	186	14.1	33.3
York and North Midland	256	25	2.7	83	9.3	119	13.2	25.2
York, Newcastle & Berwick ...	269	59	4.4	150	11.1	211	15.7	31.2
Eastern Counties	309	54	4.3	211	16.6	194	15.3	36.2
South Western....................	216	126	9.9	154	12.2	268	21.1	43.2
Brighton	162	93	5.9	184	11.6	192	12.1	29.6
South Eastern	163	40	2.6	196	13.8	310	21.8	38.2
Edinburgh and Glasgow	57½	84	5.2	242	15.1	264	16.5	36.8
North British	103	44	6.6	127	19.1	123	18.3	44.
	2915½	12) 886	62.1	2175	155.8	2955	202.5	420.4
		73	5.1	181	13.	246	16.9	35.

Averages of 12 *Lines*:—

1. Maintenance of Way ....£73 per mile, or, 5.1 per Cent. of Earnings.
2. Locomotive Charges .... 181 " 13. " "
3. Coaching, Merchandize, and General Charges, including Establishment.. 246 " 16.9 " "

£500 35 per Cent.

Comparative Working Expenses of the Great Western, Birmingham, South Western, Brighton, Leeds, and Paris and Rouen.

	1844.	1844.	1845.	1844.	July to Dec. 1844.	1843 & 1844, 1 Year.
	Great Western.	Birmingham	South Western.	Brighton.	Leeds.	Paris and Rouen.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Locomotive	0 11.927	0 12.728	0 13.238	0 15.949	0 8.460	0 16.995
Repairs of carriages . . .	....	0 1.883	0 3.302	0 2.702	1 3.346	0 2.629
Repairs of waggons . . .	0 1.476	0 0.598	0 1.224	0 0.432	0 0.751	
Passengers and goods, guards, and porters	0 6.514	0 3.075	0 4.477	0 3.831	0 2.875	0 5.819
Police	....	0 2.163	0 1.475	0 2.175	0 0.315	0 3.111
Direction and management . .	0 4.441	0 2.827	0 3.244	0 4.780	0 3 005	0 4 469
General charges	0 3.191	0 3.372	0 4.944	0 6.696	0 1.920	0 4.716
Depreciation	0 3.201	0 5.588	....	....	0 2.079	....
	2 6.750	2 8.234	2 7.904	3 0.565	1 8.751	3 1.739
Passenger duty	0 4.624	0 5.137	0 4.635	0 5.669	0 2.043	0 3.609
Rates and taxes	0 3.790	0 3 346	0 4.456	0 5.934	0 3.019	0 0.284
Rent, toll, interest, &c. . .	3 3.138	1 3.741	0 11.129	4 6.418	1 10.591	1 3.303
Maintenance	0 7.332	0 8.388	0 10.712	0 7.469	0 2.679	In locomotive.
	7 1.634	5 4.846	5 2.836	9 2.055	4 3.083	4 8.935
	Mileage.	Mileage.	Mileage.	Mileage.	Mileage.	Mileage.
Passenger trains	1,242,557	884,444	537,942	288,234	229,347	395,475
Goods trains	256,869	411,831	124,733	43,478	227,436	
Piloting	195,101	157,262	80,258	85,141	....	....
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Expenses per mile . . .	3 10.496	4 1.105	4 3.707	4 7.637	2 4.492	4 0.661
Interest	3 3.138	1 3.741	11.129	4 6.418	1 10.591	0 8.274
Profit	3 7.747	7 9.680	5 0.184	3 7.468	2 9.251	5 5.799
	10 9.381	13 2.526	10 3.020	12 9.523	7 0.334	10 2.734
Passengers	1,791,272	851,698	831,870	737,191	841,769	....

Manchester and Leeds cost of coke 18*s.* per ton ; half price of South Western.
Paris and Rouen—maintenance included in Locomotive expenses.
Birmingham—porters loading and unloading goods are to be added.

Abstract of Locomotive Expenses for 12 *Months, from* 1*st July,* 1844, *to* 30*th June,* 1845.—*H. C. Report,* 1846.

Manchester and Leeds Railway.			London and S.West Railway.
Miles run.—			
By passenger trains		459,778	804,894
By goods		522,313	182,967
By pilot engines		115,848	109,572
By ballasting		10,514	—
Total		1,108,453	1,097,434
Total cost.—			Coke at 20s.
Taking the coke at 13s. per ton		£33,000	54.000
Weight of trains.—			
Average weight of passenger trains	tons.	57.35	39.9
„ „ goods	„	177.	113.0
„ „ ballasting	„	45.	—
Coke per mile.—			
Coke per mile for the mileage of the engines	lbs.	33.88	27.08
„ „ passenger trains	„	26.15	25.23
„ „ goods	„	43,26	44.9
„ „ ballasting	„	34.14	—
Coke per ton per mile on passenger trains	„	.51	.63
„ „ goods	„	.255	.38
„ „ ballasting	„	.75	—
Oil.—			
Per mile, run by the engines	„	.0604	.03
Cost per mile.—			
Repairs per mile	pence	2.61	5.2
Coke	„	2.35	2.8
General charges per mile	„	2.18	3.5
Total cost per mile run by the engines	„	7.14	11.5
Cost per train.			
Cost per mile run by the passenger trains	„	6.95	12.3
„ „ goods	„	7.71	13.7
„ „ ballasting	„	7.75	—
Cost per ton per mile of passenger trains	„	.12	.30
„ „ goods	„	.04	.12
„ „ ballasting	„	.17	—
Engines.—			
Number of engines	No.	46	47
Miles run by each engine per annum	Miles.	24,097	15,765
Speed.—			
Average speed of passenger trains, including stoppages	„	20.11	24.1
Average wages paid each man		£1 2 9	£1 4 9

LONDON AND SOUTH WESTERN RAILWAY.

					cwt.
Number of passenger trains per diem	32	Number of miles travelled exclusive of assisting engines	2,182	Quantity of coke consumed, inclusive of assisting engines	612
Number of goods trains per diem. Number of cattle trains per diem.	6	Ditto, exclusive of assisting engines	·528	Ditto, excluding assisting engines	183
Total	38	Total	2,710	Total	795

The regulation of the tariff, or scale of charges, should be based on the broad and equitable grounds of imparting to the largest number, at the lowest remunerative rate of charge, the fullest extent of benefit to be derived from Railway communication, and to depend, wherever practicable, rather upon low fares and considerable numbers and quantities, than upon the converse of the proposition. Much care and attention will be required for the most advantageous classification of the merchandize and goods rates, on account of the inconvenience and dissatisfaction attendant upon the subsequent transfer from one to another class, when erroneously assorted at the outset. The following table will shew a general classification, uninfluenced by local or any particular circumstances.

CLASSIFICATION OF MERCHANDISE.

Class A, conveyed at lowest possible rates.—Rice, wheat, dholl and peas, pulse, grain, barley, linseed, raw cotton, wool, lime, stone, coke, coals, marble, minerals, iron, lead and copper ores, straw and hay, heavy iron castings, unwrought iron, sundries.

Class B, charged above A.—Saltpetre, sugar, jaggree, juterum, mustard seed, turmeric, castor and other oils, horns, flour, borax, caoutchouc, ginger, timber, ghee, copper, tin, lead, shot, brass and other metals, cast and wrought, piece goods and cotton manufactures, heavy machinery, sundries.

Class C, charged above B.—Opium, indigo, arrowroot, gunny bags, hides, lac and lac dye, provisions, raw silk, charcoal, toys, chunam, elephants' teeth, carpets, sugar candy, soda water, wine in casks, hardware and cutlery, ironmongery, beer in case or barrel, paints, turpentine, silk manufactures, salt provisions, salt, tobacco, cordage, sundries.

Class D charged at highest rates.—Alum, pianos and other musical instruments, fish, fruit and vegetables, preserved meats, ice, glass, china and earthenware, betel nuts, hams, cocoa nuts, hats, caps, and shoes, millinery, oilman's stores, medicines, plate, jewellery, watches, saddlery and whips, books and stationery, wine and spirits, in bottle, tea, coffee, and spices, perfumery and soap, (vitriol, gunpowder, &c., special charges), sundries.

3. *Political.*—4. *Commercial.*—5. *Social.*—The beneficial tendency and influence of Railways have been so frequently and fully expounded by writers so thoroughly conversant with the subject, and so well able to convey their opinions upon it, that a few selected extracts will alone be required for a clear exposition of their value and effects in these points of view, and will abundantly attest the services rendered, and yet to be derived, from this great auxiliary of the progressive movement of the nineteenth century.

The *Quarterly Review* thus indicates the true source of all these improvements.

"Indeed, without entering into details, the wealth which has been created and amassed since the period in question, added to that with which we have not only irrigated, but almost without metaphor top-dressed the greater portion of the old as well as of the new world, and, lastly, the extraordinary improvements that have taken place in light, heat, locomotion—electrical as well as by steam-power—machinery, in short in everything that administers to human comfort, form altogether the golden harvest of our labours; and thus, although to our eminent civil engineers considerable credit is due, they are, in fact, but secondary causes;

the engineer-in-chief—the primary inventor—the real constructor of our railways, most indisputably being *the goddess of peace*."

From a recent work on Railways, by Mr. M. Martin, the following statistical data and pertinent commentaries are extracted.

On the employment afforded:—

"The number of persons employed on Railways in the United Kingdom on the 1st of May, 1847, was, on *constructed* lines, 47,218, including secretaries and managers 124, engineers 90, superintendents 399, store-keepers 91, accountants and cashiers, 100, draftsmen 100, clerks 3,432, foremen 823, engine-drivers and assistant ditto 2,969, conductors 1,163, and artificers 10,000. The number of miles open was 3,305, and of stations 1,040.

"On lines *in course of construction* the number at the same period on 6,455 miles, was 256,509, of whom 235 were secretaries, 34 treasurers, 549 engineers, 2,382 superintendents, 1,437 draftsmen and clerks, and 240,301 artificers and labourers."

On the reduction of cost to consumers:—

"The advantages of Railways to the internal commerce of the kingdom are incalculable. The time occupied for the transit of goods between Manchester and Liverpool, before the establishment of a Railway, was 36 hours; but they were sometimes a month on the road, and the cost was 15*s.* a ton; now they are conveyed with certainty in two hours for 7*s.* a ton. Between Manchester and London the charge was 70*s.* to 80*s.* a ton, and they were several days on the road; now they are conveyed in a few hours for half the amount. The canals have been obliged to reduce their fares; in some cases they have been lowered from 33*s.* to 4*s.* Goods are now conveyed from Manchester through Liverpool or London, to America in less time and at less cost than they would formerly have been conveyed from Manchester to Liverpool.

"The charge for goods by waggon was, until the establishment of Railroads, as much as 1*s.* a ton per mile, at an ordinary speed of 2 to 2½ miles per hour, and by canals from 6*d.* to 1*s.* per ton at a less speed, and delayed during winter for weeks. Now the

"London and North Western Railway" carry bale goods at 2*d.* a ton, at a speed of 20 miles an hour. In fuel the advantages have been enormous; the price has been greatly reduced to the poor in inland districts, and is not higher in winter, when most wanted, than in summer; rail trucks are not stopped by frosts like canal boats. The farmers have benefited by the cheap conveyance of manures, of limestone, chalk, &c., and by the carriage of their live stock, grain, &c., to good though distant market-towns."

On the increased value of landed property—

In many places land that was of little value, or not cultivable, for want of draining tiles, or lime, or manure, was by the establishment of a Railway brought into profitable use, and the area for the production of food in the three kingdoms has thus been largely increased. By the conveyance of live stock on rail, instead of driving them on the roads, a saving is effected on pigs, sheep, and cattle of 2 to 10 per cent., independent of the more healthy state of the meat.

On the diminished loss by peculation—

"There has been a great saving to merchants in the *security* as well as in the rapidity of transmission of their goods. The report of a commission which sat fifteen or sixteen years ago to inquire into the loss of merchandise entrusted to carriers, to canals, &c., disclosed a system of plunder of the most extensive nature; there were regular depôts for plundering and disposing of the property along the traffic lines. In wines and spirits the abstraction was very great, and the deficit was made good with *aqua pura.* All this is now remedied; the losses and delays are comparatively few, considering the variety and amount of the traffic; and traders with small capital can order in from time time, according to their wants, stocks of goods, sure of their delivery almost by return of post; thus facilitating and increasing commercial transactions without necessitating a corresponding augmentation of capital."

On the numerous attendant and collateral advantages—

"Then the improvements that have taken place in country towns through which the Railways pass,—in buildings, roads, bridges, lighting,—are manifest to the most ordinary observer.

The advantages derived in postal communication are almost incalculable. The money-orders sent through the Post-office in three months of 1839, amounted to £90,000, but in three months of 1848 it amounted to £3,500,000.

"Private individuals have from their own resources constructed in the United Kingdom, within the past ten years, works of greater magnitude, in reference to utility, than have ever been made in any country in the world."

"The introduction of Railways has, however, enabled England to regain her advanced position by the wonderful spring given to internal commerce, and the extraordinary impulse which the *mind* of the nation has received in a few short years. In every direction we see progressive improvement; in the comforts and appearance of the people, and far greater consumption of the necessaries and conveniences of life; in the substitution of mechanical power for mere human or animal labour; in the peaceful, orderly, self-respecting demeanour of the poorest classes; in the multiplication of small dwellings; in the great attention paid by the Sovereign and her royal consort, and by Government, the Legislature, and the higher classes, to the improvement, cleansing, and sanitary state of the densely populated cities; in the superior architectural taste displayed, and especially manifested in the admirably constructed Railway buildings and stations—such as those at Derby, Chester, Crewe, &c.; and in the diminution of crime, the preservation of property, and the obedience to the laws.

"In these and other points, England still maintains her superiority over every other country; and it can scarcely be denied that Railways have contributed in no slight degree to promote and to secure the above-mentioned benefits.

"The Select Committee on Railways of the House of Commons, in their Report of 25th August, 1846, dwell '*on the immense importance to the community of a judicious system of Railways*,' and state that, '*it is hardly possible to exaggerate the importance of a Railway, not only to the great cities which are connected by it, but to the districts through which it runs. New branches of industry are everywhere called into existence by the facility and cheapness of communication afforded by Railways, and land previously of little or* *no value is at once made productive, by cheap access to materials by which the soil may be improved, and to markets for disposing of its produce.*' "

"By means of Railways, cheapness of production has led to cheapness of price; and now, or, if not now, very soon, England will, in all that concerns the necessaries and comforts of life, be positively and relatively a cheaper country than any other in the world, and can, therefore, have no reason to fear commercial competition with foreign nations."

"The establishment of a system of internal communication, unexampled in any age or in any country; a concentration of power for governmental purposes, of incalculable political and military importance; a facilitating and economising of personal transit, and of mercantile traffic, which has augmented individual and national wealth; the rapid conveyance of troops, police, and intelligence—of the highest consideration for the maintenance of peace against foreign aggression or internal disturbance; a closer and more frequent communion between different parts of the kingdom, to the great improvement of social intercourse,* and the inculcation by example of order, punctuality, and systematized industrial habits, which can scarcely fail to exercise a beneficial influence on the labouring classes of society."

On the unexpected effect upon the traffic of the canals—

"Now, in the annals of political economy there can scarcely exist a more striking exemplification of the extraordinary extent to which the latent resources of a great country may be developed by lowering the tolls of its goods traffic, than the fact, that notwithstanding the enormous amount thus conveyed along the London and North Western rails—the quantity carried along the Grand Junction Canal, which meanders alongside its powerful antagonist, instead of having been drained, as might have been expected, to Zero, has from the opening of the Railway in 1836 up to the present period actually increased as follows :—

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* But for the Railway system, the penny postage could not have been carried out.

Average amount of goods annually moved on the Grand Junction Canal, during the three years prior to the opening of the London and Birmingham Railway in 1836 ....tons	756,894
Average amount of ditto, annually moved during the *twelve* years subsequent to 1836 ....tons	1,039,333
Amount moved in 1837...........................tons	1,163,466."

On the comparative rates of charges at home and abroad, and the benefits conferred on the labouring population—

"Mr. Shaen, jun. makes the following computation of charges (per mile) abroad compared with those in England; but, in order to compare the fares correctly, he makes allowance for the taxes levied on the English lines—viz., passenger duty 5 per cent.; local assessments, about 4 per cent.; income tax (upon about two-thirds) 2 per cent.; and taxes on deeds, transfers, and receipts, about 1 per cent.=12 per cent. on the whole. So also as regards France and Prussia:—

	1st Cs.	2d Cs.	3d Cs.	Horse.	Ox.	Coals.	Bale Goods.	Fine Gds.
Belgian pence	2·44	1·86	1·16	6·44	1·21	1·61	2·415	3·22
Lond. & N. W.	2·10	1·50	1·00	2·97	0·85	0·87	2·000	3·03
France.........	...	...	...	...	1·66	1·67	3·003	3·03

"Our third-class fares are 3 per cent. lower than those of the French, although the accommodation and speed on our lines is far superior."

"In the 'excursion trains' in England, passengers are conveyed at the rate of three-tenths of a penny per mile; and on the Glasgow and Greenock line, the third-class passengers have been conveyed by ordinary trains at one farthing per mile! On the American Railroads there is seldom more than one class conveyance, and the charge is about 2*d.* per mile, or 2·5, and for goods 3·5 per ton per mile."

"The proportions of the three classes were, according to Mr. Harding's statement, in

	1842.		1847.
First Class	20·2	....	14·2
Second "	45·4	....	38·3
Third "	34·4	....	47·5
	100		100

“In 1842, the third class formed about one-third of the traffic; in 1847, nearly one-half.

“The labouring classes have therefore benefited most by Railways; wherever they could sell their skilled or mere manual labour at the best price, they have been enabled to transport themselves thither immediately at a cheap rate.”

“Wherever economical facilities have been established by omnibus, boat, or rail, the traffic has enormously increased. Where a 6*d.* fare omnibus would not pay, a 3*d.* fare has been established, and a profitable traffic at once obtained.”

“It is correctly observed by the Committee of the House of Commons, that “cheapness of fares may create a traffic which otherwise could not possibly exist; the charge which, with a traffic of 20,000 tons, would only be remunerative at 10½*d.* a mile, with a traffic of 1,000,000 tons would be remunerative at about *a halfpenny per mile.*”

On the comparative results of the system, during years of abundance and distress:—

“A remarkable illustration of the progressive state of the Railway system, and how much has, within the last few years, been done for the public by the proprietors of Railways, is afforded by the following comparison on the London and North Western line during the years 1844 and 1848, the former a year of high prosperity, and the latter one of severe commercial and general distress:—

“1844.

	Number.	Receipts.
1st class passengers	815,716	£521,746
2nd ditto	921,160	316,326
3rd ditto	159,192	56,984
No record of class	...	15,502
Total	1,896,068	910,558
Goods, mails, parcels, &c.		582,667
Total receipts		1,493,226*

Miles open, 263. Miles run, 82,522,861†.

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* Exclusive of the Manchester, and Birmingham and Bolton branches.

† Passenger trains only.

"1848.

	Number.	Receipts.
1st class passengers	959,316	£466,088
2nd ditto	2,472,423	468,035
3rd ditto	2,569,608	235,269
Total	5,999,347	1,215,492
Goods, mails, parcels, &c.		978,600
Total receipts		2,194,092[*]

Miles open, 435. Miles run, 195,129,791[†].

"Thus, with an addition of 172 miles in 1848 to the 263 miles open in 1844, there was an addition to 1,896,068 of 4,103,279 passengers, and in receipts an augmentation of £700,876; the principal augmentation was on the goods traffic receipts.

"The average receipts of the London and North Western principal lines are now £5,046 per mile, per annum, which is a high range of revenue; and, under a fair state of commercial activity, the annual receipts may soon be expected to average *three millions sterling*.

"Capt. Huish thus states the traffic on the London and North Western Railway for the year ending 30th June, 1848:—

	Receipts.	Mileage run.	Recpt. per mile.
Passengers	£1,417,659	4,220,078	6*s.* 8½*d.*
Goods and coals, &c.	722,376	2,626,049	5*s.* 9*d.*"

"The total *weight* of passengers carried by the London and North Western for the year ending 3rd June, 1848, was 399,956 tons over a distance of 4,220,078 miles, a tonnage which does not amount to *one-fourth* of the merchandise traffic in the year, while the mileage of the latter is about half that of the former annually."

On the danger of pursuing a false system of apparent economy—

"Efficiency, in every particular, by means of the best instruments and the most trustworthy agents, is imperatively essential. A false economy in any of these might cause the loss of life and limb to an immense extent; it is only by the possession of ample funds, and by paying a liberal remuneration for talent and good conduct, that a Railway can be maintained in safety for the public, and with benefit to its proprietary. Cheapness, carried to such an extent as to leave no profit, leads in any business to the speedy ruin of the seller; but in a Railway, such cheapness involves not only ruin to the vendor, but destruction to the purchaser; and this constitutes a main distinction between competition as applied to Railways, and the same principle when applied to the sale of boots and shoes."

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[*] Exclusive of the Manchester, and Birmingham and Bolton branches.

[†] Passenger trains only.

"It can never be the interest of the public to prefer cheap to safe travelling."

"So long as a manager of a Railway has ample funds, he ought to be prepared, regardless of expense, to repair with the utmost possible despatch the falling in of a tunnel or any other serious accident to the works; in short, the whole powers of his mind should be directed to the paramount interests of the public, which, in fact, are identical with those of the Company. But if he has no funds, or what is infinitely more alarming, in case, from want of funds, the impoverished proprietors of the Railways shall have angrily selected in his stead the representative of an ignorant, ruinous, and narrow-minded policy—how loudly would the public complain, how severely would our commercial interests suffer—if on the occurrence of the works to which we have alluded, the new ruler were to be afraid even to commence any repairs until he should have been duly authorised by his newly-elected economical colleagues, to haggle and extract from a number of contractors the cheapest tender!"

"It becomes, therefore, of paramount importance, that the management of these vast national concerns should devolve upon men not only of the highest business talent, having a pecuniary interest at stake in the prosperity of the property, but also holding such a position in society, as shall place their conduct as far as possible above impugnment

"The duties which devolve upon the executive of our great Railways under existing emergencies are onerous, and involve grave responsibility. Much is expected from them by the public on the one hand, and by their proprietors on the other, and it will require no ordinary degree of firmness, and a combination of foresight and of patient industry, to conduct successfully, and with credit, the undertakings confided to their care, and to produce an organisation economical and at the same time efficient."

"Under such circumstances, the executive should not hesitate to do that which their duty to their proprietors demands, namely, the attainment of the highest degree of efficiency and economy, regardless of all other considerations."

On the number and classification of the persons employed on the London and North Western Railway, and by one of their principal carriers—

"Although our limits do not allow us to enter into many statistical details, we may mention that the number of persons employed on account of the London and North-Western Railway Company, including those occupied in the collection and delivery of goods, is as follows :—

2	Secretaries to the Board of Directors.
1	General Manager.
3	Superintendents.
2	Resident Engineers.
966	Clerks.
3,054	Porters.
701	Police-constables.
738	Engine and Firemen.
3,347	Artificers.
1,452	Labourers.
Total number 10,266	

The number of horses employed is . 612
Ditto vans, &c. . . . . 253."

"Messrs. Pickford's establishment, on account of the London and North-Western Railway, is as follows :—

Clerks.	Porters.	Horses.	Vans.	Waggons.	Drays.
234	438	396	82	57	25

"The weights carted by Messrs. Pickford, on account of the Company, for the year ending the 30th of June last, amounted to—

	Tons.	cwts.	qrs.	lbs.
Collected	133,437	18	0	15
Delivered	139,898	19	0	5
Making a gross total of	273,336	17	0	20

Or rather more than 841 tons per day.

"And yet the Company's merchandise operations at Liverpool exceed those at London in the proportion of 9 to 6½!"

"In Messrs. Pickford's receiving shed, which is 300 feet in length by 217 in breadth, there are in operation, for the purpose of rapidly loading and unloading goods—

24 steam cranes,
21 wooden cranes,
1 steam-doller or lift,
1 travelling-crane on the roof,
1 steam-capstan for hauling trucks along rails to the various loading bays.

"We observed also at work, 4 steam hay-cutters, which cut 200 trusses in four hours, and 1 steam hay-cleaner. The above machines are worked simultaneously by an engine of 16-horse power, which also raises from an Artesian well, 380 feet deep, water, which is given warm to 222 horses in adjoining stables. These horses are all named, and branded with a number on their hoofs."

The importance of restricting the cost of a Railway is succinctly shewn in the same work:—

"Supposing 5 per cent. be deemed an adequate return to railway proprietors for the capital they have expended, the comparative charges to be levied by them on every passenger or ton of goods would, on a given traffic, be as follows:—

Charge per mile on a Railway which ought to have cost 15,000*l* per mile . . .	1*d*.	per mile.
Ditto on a Railway which has unnecessarily been made to cost 20,000*l*. per mile . .	1⅓*d*.	„
Ditto on a Railway which has unnecessarily been made to cost 25,000*l*. per mile . .	1⅔*d*.	„
Ditto on a Railway which has unnecessarily been made to cost 30,000*l*. per mile . .	2*d*.	„.

The following is an extract from a forcible and energetic appeal to Lord J. Russell upon the subject of extending to British dependencies the inestimable benefit of Railway communication:—

"It is impossible for any reflecting mind to exclude the conviction, forced upon it by the experience of the last century, that events are rapidly tending to that consummation of the world's existence which is to precede and attend its full maturity. The ends of the earth have, within the last few years, been rapidly brought together, as it was foretold should be the case; the spread of intellectual knowledge has extended, and is extending, with a rapidity and in a degree that forbids the possibility of any interest remaining stationary, and the mighty design of all human operations appears to be hastening towards its final accomplishment in the universal diffusion of Divine knowledge—the end towards which the rise and fall of nations, and the flow of commerce, have always been the powerful instruments. Of all the causes contributing to these results, none has been so widely influential as the application of steam, in the means it has afforded for locomotion by water and by land. By the former adaptation, the Eastern and Western hemispheres have been made accessible as it were by high roads over the seas, traversed at short and set intervals, in a space of time scarcely greater than within a few years was requisite to communicate between the remoter parts of our own island, or the nearer points of the Continent. By the latter, a means has been created of neutralizing the effect of time and space, by rendering the most lengthened journeys no longer a matter of physical labour or difficulty, and by accelerating the rapidity of conveyance almost beyond the speed of the elements. How much the Railroad system has done, and in how short a time, towards the civilization and advancement of the great continent of North America, is too well known to need relation. The Continent of Europe, in like manner, wherever Railroads have been established, has been opened to the world, and has become in a great measure a country common to the inhabitants of its remotest parts."

The *Times* concisely epitomises the duties of government in regard to the extension of Railways to the Colonies :—

"Without the introduction of Railways into our Colonies, it is impossible that the Imperial Legislature can discharge to our innumerable dependents those sacred duties which it owes them of improving their social and physical condition to the greatest extent permitted by the science and resources of the age; and without the direct aid and sanction of the Government, it is impossible to expect that private capital can be made sufficiently available for so strange a purpose in so remote a field."

The collective benefits of Railway communication are more specifically defined by another writer in the following paragraphs :—

"Among the principal points upon which all are agreed, may be enumerated :—

"1. That the value of land and property, generally, is increased by a Railway passing through or near it, and connecting it with a shipping port or other large market, to an amount varying from 100 to 600 per cent. on an average; the increase, in many instances, having been infinitely beyond this proportion.

"2. That cheap, rapid, and secure means of transport have had the effect of increasing the produce and manufactures of the districts to which it has been applied, to an extent varying from 75 to 350 per cent.

"3. That the same facilities have increased the number of persons travelling, in the average proportion of 400 per cent.

"4. That the extent of these advantages is estimated by, and bears a direct proportion to, the greater or less facilities of transport previously existing.

"5. That the benefits are directly proportioned to the extent of country traversed.

"6. That cheap fares (which involve the previous conditions of moderate cost and large traffic) will increase the number of passengers in inverse proportion to the rate of charges.

"7. That the ascertained traffic in goods and passengers has invariably increased in this proportion; and—

"8. That, as a means of consolidating and securing the stability of the Government, of improving the civilization and produce, of extending the commerce of the country, and of ameliorating the condition of the people, there is no other instrument of equal effect or capable of producing, in a corresponding brief period of time, anything approaching to a corresponding beneficial result."

Another extract, from one of the recent popular publications, will suffice to illustrate a view of the subject upon which all are agreed, but of which the especial argument and grounds are not perhaps so generally understood.

"In the course of the observations which I have made, I hope the following propositions have been established: some are so self-evident, that it would be a mere waste of words to do anything further than notice them.

"1st. That the introduction of Railways has made a great and beneficial change in the mode of transit in this country; that, in the words of an eminent writer in the *Quarterly Review*, 'They are the well-spring of intellectual, moral, and political benefits, beyond all measurement and all price,—creating such a revolution in the internal trade and resources, as no thinking man can contemplate without being lost in wonder.'

"2nd. That the benefits which a country, especially a great commercial country, enjoys from a free and uninterrupted communication throughout its length and breadth, are almost incalculable; and that in proportion as facilities by reduction in charges are afforded for such intercourse between its different parts, in the same proportion is trade and commerce stimulated, and not only one portion of the public relieved from a heavy charge, but the great bulk of the community is admitted to these advantages, of which otherwise they would be deprived."

"That great as those political and commercial advantages would be, the social and moral advantages would be still greater. The barrier would be removed that separates man from man. That which is, in itself, and must ever be, a monopoly, would be converted from the sordid vehicle of gain to the noblest instrument that science ever invented, or philanthropy employed, in extending and promoting the happiness of mankind. If it be a blessing that man should be enabled to go abroad and behold the works of his Maker; if it be a blessing that the sickly artisan, pent up in the densely populated city, or inhaling the pestilential atmosphere of the crowded manufactory, have it within his power to use a short interval snatched from labour in renovating his worn down frame; if it be a blessing that friend should meet friend, who are divided from each other, though not perhaps fifty miles apart, as effectually as though the broad waters of the Atlantic rolled between them; if, in a word, it would be a blessing that time and space for all practical purposes of communication should be annihilated, and that man, flying as it were on the wings of the wind, should enjoy to the fullest extent every happiness and comfort which the economy and rapidity of this mode of travelling can confer; if all these be blessings, they are within the reach of the people of this and every other country where Railways are established.

"8th. That the adoption of the proposed plan would do injustice to no man. That it would not diminish any branch of direct revenue, but increase many branches indirectly; and that as it is detrimental to no particular interest, nor can be offensive to the prejudices of any party, it should be adopted."

"There are other considerations connected with this subject which I need not do more than glance at. That knowledge would be extended, and religion and morality advanced, by an increased facility of communication with those parts of the country which require it most, can scarcely be doubted by any thinking man. The evidence adduced before the late Parliamentary Commission appointed to inquire into the state of children in the manufacturing and mining districts, presents a deplorable picture of the immorality and ignorance prevalent in some of the most densely populated districts. The influence which a comparatively free means of communication might be expected to exercise in abolishing these evils, will be best described in the words of a distinguished statesman,—one who possesses more power to carry out his own views and feelings on this subject than any man in existence. 'The steam engine and railroad,' said he, on an important occasion, 'are not merely facilitating the conveyance of merchandise from one part of the country to another, they are doing more, they are sealing the intercourse between mind and mind, and they are creating demands for knowledge, sending the desire for that knowledge into all the recesses of this empire, tending powerfully to the cultivation of the mental, as they are improving the physical capabilities of the country."[*]

"During the year 1847, there were conveyed in round numbers:—

Seven million tons of merchandise and goods.
Eight million tons of coal.
Half a million horned cattle.
One and a half million of sheep.
A hundred thousand horses.

Of the gross sum of £8,366,000, the passenger receipts were	£5,024,000
Receipts from all other sources, goods, carriages, cattle, parcels, mails, &c.	3,342,000
In every £100 of receipts, the passenger traffic of 1847, therefore, formed	60 per cent.
The traffic receipt	40 ,,
In 1842, the former was	64 ,,
——— the latter was	36 ,,
The total number of passengers carried in 1842 was	22,403,478
——— in 1847 was	47,484,134
The average distance travelled by each passenger in 1842, was	13 miles.
——— in 1847	16 miles."

The gist of the political, commercial, and social bearings of the entire question is, after all, contained in the few following lines.

"Railways have, when properly selected, been invariably attended with the following results—increased Government revenue—increased value of all property—increased cultivation and produce, and extension of manufactures—increased accommodation to all classes for intercommunication—diminished cost of all descriptions of goods to consumers, and increased consumption by accession of numbers—diminished risks of war and insurrection, with increased powers for their suppression—a measure of universal benefit without a drawback or objection, if selected, and carried out under due provisions, with judgment and discretion."

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[*] Sir Robert Peel's Speech on his inauguration as Rector of Glasgow University.

A brief and cursory notice of the peculiarities of Foreign Lines, which are especially applicable to Colonial purposes, may not be unacceptable or out of place at a period when their extension to distant parts occupies no inconsiderable share of public attention.

In the British Colonies generally, and in India, certain elements of economy are usually to be found, while on the other hand, specific items of construction will as invariably exceed the usual average cost in England. The adjustment of these distinctions, and the adaptation, when practicable, of the means indicated as the most suitable and least costly, to the partial exclusion or diminution of the more costly principle, constitutes the primary consideration to be entertained.

In illustration, it may be adopted as a measure of economy, that provided the efficacy be established of some one or more of the ingenious processes for preserving timber against decay and insects, that material should be permitted to enter largely into the construction of a Railway, which does not constitute the trunk line of an entire system. The exception will be intelligible from the fact, that the trunk line of an extensive series essentially requires to be of the most solid, substantial and permanent description, whereas branches and less important lines will be more economically made by a less original outlay and more frequent renewals.

The interruption to the regular traffic upon the trunk so seriously affects the aggregate traffic of the line and of its tributaries, that a considerable amount of additional first outlay, to render renewals and repairs as unfrequent and distant as possible, is an established axiom in Railway economy.

The prejudices which at one period limited the gradients and curves upon Railways, to an extent to materially augment the cost of construction, are already much weakened in England, and in Colonial works should be sedulously eschewed.

It will usually be found consistent with sound economy to limit the heavy works where practicable, by admitting less perfect gradients and smaller curves than are usually deemed necessary. Curves of 200 yards radius may be used at a station, and gradients of 1 in 200 admitted. Curves are especially objectionable in cuttings, as limiting the view of the line and approaching trains; and on steep inclines, because the descent necessarily imparts additional velocity where the speed should be checked. They should, when unavoidable, be used where they will be exposed to view at a considerable distance, or near stations, where the speed is lessened. The gradients should in all cases descend from, and not incline towards a station, as the imparted speed is in one case as useful, as in the other it is objectionable.

Upon occasions requiring unusually sharp curves, a guide rail about 2 inches higher than the rails of the line may be laid down between them, parallel with and near enough to the inner rail to prevent the wheel leaving it.

The permanent way is an item upon which there will rarely be found an exception to the sound general rule, that it shall be strong and substantial, and may be regarded as the only part of the outlay upon which the tendency to economise should be sparingly and cautiously exercised.

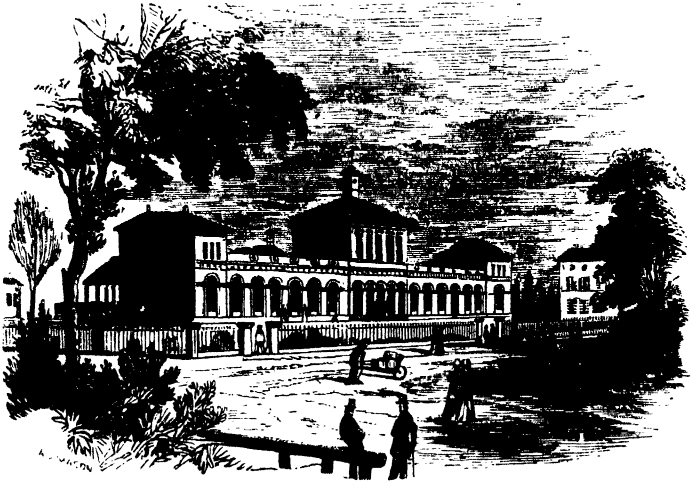
In tropical climates, from the rapid growth of vegetation, the fencing will be cheaply provided, by the use of that description of bush, shrub, or tree, which is found in the country to be most suitable for the object. The same influence will contribute to strengthen and consolidate the earth works.

The adaptation of the tools, and usage of the country to the operations to be performed, will be found desirable to a certain point. In milder climates, the objection to heavy instruments will not be raised; but in the East or West Indies, the strength of the labourer cannot with impunity be over-taxed, and the introduction of European appliances should be made with due regard to the customs of the country.

In the East, for instance, earth works are by no means a new or unfamiliar subject. The bunds or embankments thrown up to controul the rivers and water courses, as well as the tanks of 60 and 80 feet in depth, for supplying water for domestic purposes or irrigation, have familiarized the native mind with operations hitherto performed upon a large scale, with the most simple and primitive implements, and at a cost which, under ordinary circumstances, precludes the necessity or advantage of costly machinery.

Simplicity is the characteristic of eastern contrivance, whether applied to the plough, the loom, the mill, or the hand instruments.

The use of stone or brick will necessarily depend upon

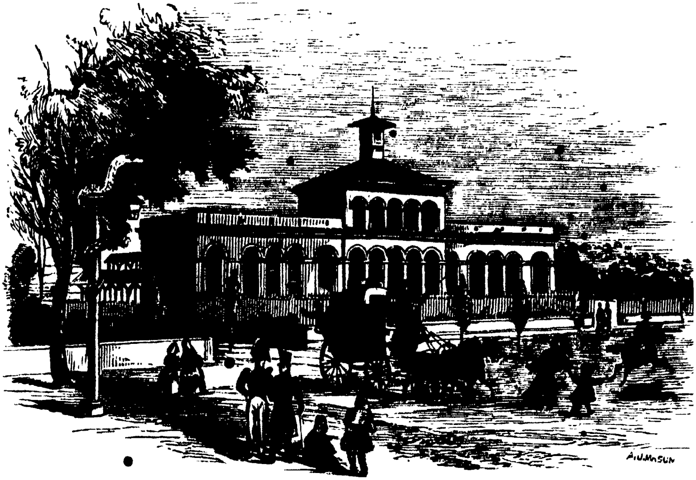


Station at Francfort-on-Maine.

and be determined by local facilities, which vary too sensibly to admit of or require more special mention in regard to their comparative economy.

In tropical climates, the contraction and expansion will require more ample provision to be made than is necessary in milder climates, in which, for instance, the space left in laying the rails, between every 15 feet length, is a full one-eighth of an inch. The risks of fracture of the cast-iron chairs will also be materially increased by the alternations of temperature during the day and night.

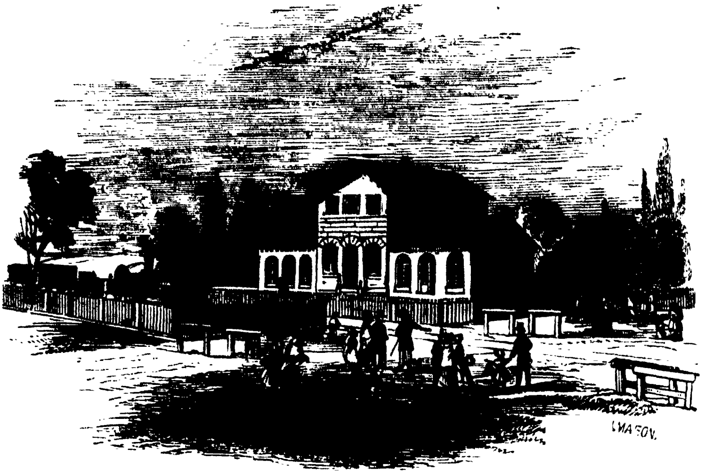
The laying down of a single line of rail, at the outset of a new undertaking, is a prudential measure of economy, which should be enjoined, assuming that the bridges, earth works, and other parts are provided to admit



Station at Wiesbaden.

of the second line (when a double line is contemplated and required) being laid afterwards. The saving in ballast and iron work upon lines on which a future large traffic is expected, and which are to be constructed with that view, will be considerable, and the experience gained in the earlier works rarely fails to bring with it some advantage in ulterior operations.

The repairing shops, stations, both terminal and intermediate, should be laid out originally with a view to the full and extended traffic, limiting the tools, machinery, and internal arrangements to the immediate wants of the Railway, and taking especial precaution that in the gradual and progressive extension to provide for the increasing traffic, they shall eventually present a consistent whole, and not a series of detatched and unconnected contrivances.

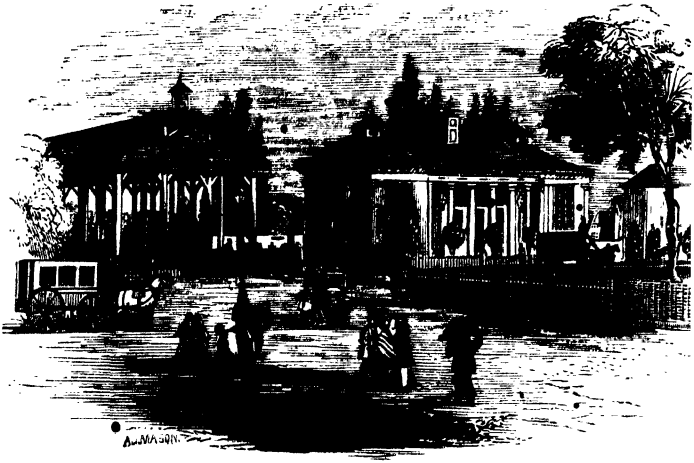


Station at Hochst.

It is an evil which, having occurred on English lines, should never recur, as the justification of inexperience will not now avail those who proceed with the foreknowledge of what is to be imitated or avoided.

The simple and economical character of the stations generally on the Continent and in America, are especially deserving of imitation, as structures which can at all times be enlarged, extended, altered, or rebuilt, without interruption to the traffic, and the ultimate dimensions and appliances of which cannot, in many cases, be determined until after the line has been for some time in operation.

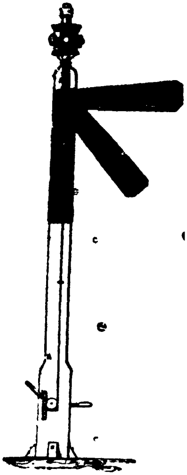
The general character and appearance of the Continental stations, will be understood by reference to the accompanying sketches, from the description already referred to, of the Taunus Railway.



Station at Castel.

In signals and telegraphs there is little to be observed, except that a preference appears due to the subterranean principle of conducting the wires, previously coated with gutta percha, in cast iron or other pipes over the plan in more general use;—the great objection of derangement from the electricity of the earth having been removed by the use of the double and oppositely charged needles on the same bearing. The Prussian telegraph system is of this description, and is found to work effectually.

The basis of the signal system is simple, and should be adhered to. The three positions of a telegraphic arm by day, and the three colors of a lamp by night, comprehend the alphabet and vocabulary of ordinary practice. The diagram shews the distinction.



The horizontal arm, or the red light, intimates danger, and the necessary stoppage of the train.

The intermediate position of the arm, or the green light, enjoins caution, and a diminished speed.

The dependent or vertical arm, or the white light, implies that no obstruction exists, and that the train may proceed.

The subject is fully and ably illustrated in the first and second parts of Mr. Weale's new edition of *Tredgold on the Steam Engine.*

The slopes at which materials in cutting or embanking will stand are more variable than is usually supposed.

Where the value of labour is high, it is necessary to economise the quantity of the earth works; but in those colonies in which the price of labour is so moderate, that the earthworks of a Railway will not constitute a heavy item of expenditure, the inclination of the embankments should be sensibly diminished.

From a mean of experiments made at various periods, the natural slope of fine dry sand is given at 35° 30′; of dry ground, 37°; of dry loose shingle, 30°; of dry earth, 46° 50′; of damp earth, 54°; of dense and compact earth, 55°. In embankments and cuttings the slopes will depend so much upon local circumstances, that no secure data can be given for general practice—the same clay in a wet situation requiring slopes of 3 to 1, which in a dryer state will stand at 2 to 1. Chalk will stand at $\frac{1}{4}$ to 1, or nearly perpendicular, and compact sandstones at 1 to 1. Sand will, with a perfect drainage, occasionally stand at 2 to 1, and granites, where the felspar is readily decomposed, cannot be depended on without proportionate allowance being made. In some clays 4 to 1 has been found indispensable, while on similar materials, by judicious back drainage, 1½ to 1 has sufficed. Ordinary earth works may be taken at 1½ to 1; but it will generally be found cheaper to give an increase to the proportions usually adopted.

One of the most important points for securing sound and lasting work, is the drainage, and an adequate provision for water way. The apprehension of the destructive effects of vast bodies of water may be relieved to a considerable extent by this precaution, and the observation applies with equal force to all countries. When the usual and the extraordinary overflows of rivers, lakes, and mountain torrents can be ascertained, there is little difficulty in providing effectually against their ravages in Railway works. The difficulty exists only in cases where the elements for calculation are unknown and cannot be determined. The inundated works in Holland, and in some of the Southern States of America, attest the results of due and sufficient provision being made beforehand.

The use of locomotive engines, whatever may be their form or principle of construction, of a weight not exceeding 18 tons, will contribute greatly to preserve the permanent way,—and, on all Colonial Railways, will be found amply sufficient for every useful purpose.

A small working stock should, in the first instance, be sent from England; and eventually the carriages, waggons, trucks, &c., will be built under greater advantages upon the spot, the iron-work, and wheels and axles being sent out ready prepared.

The use of wrought iron has the recommendation of lightness and portability, without risk of fracture, and of being susceptible of a combination of the greatest strength, with the least quantity of material.

Iron enters so largely into the composition of a Railway, that particular reference may be not inappropriately made to its varying influence on the economical cost of the works.

Supplies of iron may be depended on in all the Colonies at an average price, estimated at a mean between the present depressed state of the trade and the high prices attained during the last two years; but in several parts it will be found more advantageous to obtain certain descriptions of iron from the iron-works, which will necessarily be built wherever the ores and fuel are found in any abundance, and the certain demand of public works indicates a sure and remunerative market.

In Canada and the Australian Colonies, iron has not yet been worked to any useful extent. In India iron is abundant, and is worked by the native population in many parts, upon the limited scale which the want of capital and machinery necessarily prescribe.

The costly but successful experiment which, during the last few years, has been made of the oxides and hematites of India, has so fully established their character and suitability for the production of a very superior description of steel, as well as of bar, rod, hoop and sheet iron, and of castings requiring great strength and toughness, that there can be little doubt of these operations being largely and beneficially extended, and a local supply secured, as soon as the proposed Railway operations are actively commenced.

The insufficiency of the price of iron-work, as the single criterion by which to be guided in the purchase of materials, of which strength is required to constitute a principal element, has been recently confirmed by the results of an investigation upon bars cast of the pig metal, proposed to be used to the extent of about 8,000 tons, in the extensive fire-proof warehouses of the Albert Dock, at Liverpool.

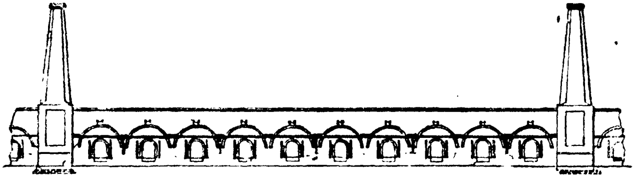
The superior strength of the iron supplied by the Messrs. Walker, of Gospel Oak Works, who obtained the contract, may be attributed to the long experience they have had in the manufacture of heavy ordnance, in which the quality of the metal is a consideration of vital consequence.

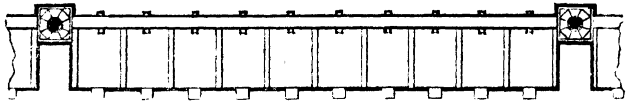
The lowest priced iron is, in Railway operations, the dearest. The slight hot-blast castings, which are run from the blast furnace, cannot possess the degree of strength to resist the continued exposure to fracture in the carriage, transhipment, landing, keying up, and atmospheric influence, which would be obtained from superior and, of necessity, dearer material, and the waste from these causes, will usually attest the fallacy of such views of economy. The usual stipulation for second runnings and particular mixtures of pig iron, afford no security, owing to the impossibility of their being effectually enforced; and because the price, in most cases, determines the question.

In wrought iron, the distinction is no less marked and invariable.

The cost of coke must depend materially upon the facilities which are available for the supply, either from collieries in the country, or by import. In the latter case, the expense will of necessity be heavy. In the former, it will diminish in proportion to the proximity of the coal works to the Railway. When a line passes through or near a coal district, it will be desirable to build the coke ovens upon the spot. Arrangements for this purpose may be made with the coal owners to burn and supply the coke at a station on the line, or the ovens may be erected by the consumers, but the site should be selected where the carriage will add but little to the cost.

The form and principles of construction of the most improved descriptions of coke ovens are shewn on the accompanying diagrams:—



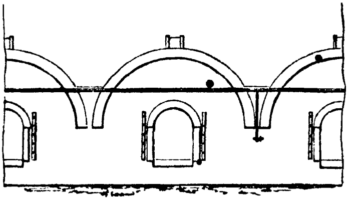
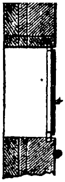
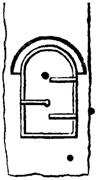
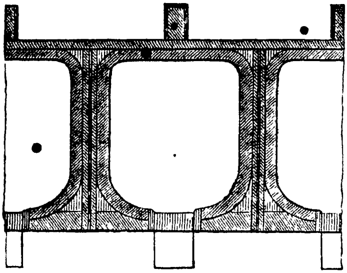
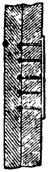
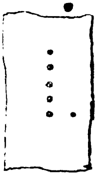
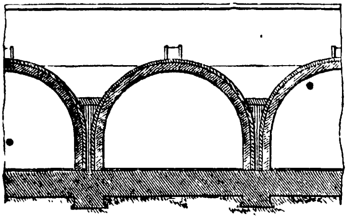
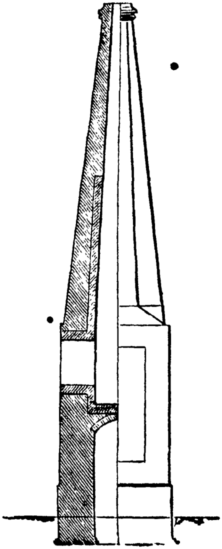
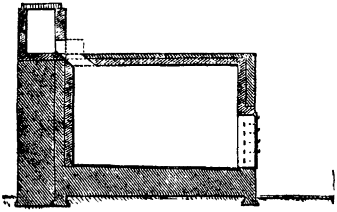


The dimensions of the coke ovens, their charges, and the time allowed for burning, vary upon all lines.

The usual charges are about 4 tons of coal, and drawn after 48 hours; but ovens have been constructed for 7 and 8 ton charges, and the time extended to 72 and 96 hours. By longer burning, the coke becomes harder, and is preferable for some engines.

The yield averages of good coke about two-thirds of the weight of coal.

The diagrams shew the largest sized ovens calculated for 8 ton charges, and with the flues upon the most improved construction.

One vital consideration for the advocates of true economy in all public works should be a rigid determination to employ only those who, upon their undisputed qualifications, can establish their claims, and by adequate remuneration, to secure their earnest good will and zealous co-operation in a cause in which success or failure, with their elementary circumstances of gain or loss, economy or waste, are mainly influenced and produced, as the instruments are well or ill-selected and adapted to the demands upon them.

High salaries will not invariably secure good service, but good service cannot assuredly be obtained except it be sufficiently recognised. If extraordinary exertions and combined judgment, integrity and ability, are essential to the success of any particular operation, the pecuniary saving which may be effected in the machinery by which it is to be accomplished will, in most cases, be found eventually to have been dearly purchased. The power for good or ill, for economy or extravagance, for profit or for loss, which must of necessity be exercised by those who are entrusted with considerable delegated authority, is such, that no reasonable endeavour should be disregarded to enlist the utmost measure of co-operation, not as mercenaries, but upon the higher grounds of a common and reciprocal, a liberal and legitimate interest.

The policy of permitting participation in the profits by the employés in particular departments of a Railway has been tested, and found eminently successful upon both English and Foreign lines. The practice implies an advanced state and degree of attained perfection in the arrangements, which render it unnecessary to do more than to refer to it, as deserving the especial attention of the directors of Colonial Railways, when the period arrives at which it can be introduced.

Of the propelling power in present use, and its particular application upon Railways, it will be unnecessary to give any description, as the locomotive engines of different manufacturers and principles of construction, will form the subject of a separate work.

The possible future use of the electro magnetic, the gas vacuum, the xyloidine or gun cotton, or other chemical principle of producing and imparting motive power, however interesting as an abstract enquiry, cannot here be appropriately considered.

The atmospheric principle of traction will not require more than a passing notice, that having been tried and abandoned, except upon one short line in Ireland, its consideration, as an economical element of calculation for practical purposes, will not be necessary.

The uniformity of returns of all the details of cost of construction, maintenance, and working, is a question of so much importance, that it is to be hoped it may engage the attention of those who, having the opportunities, will not disregard them, of enforcing compliance with a measure which is so conducive to the general benefit.

With this object, a Table is added at the end of the work, as a ground work upon which such a form may be hereafter perfected and agreed to by the Directors of home and foreign lines, as shall be shewn to afford the complete means of practical and useful conparison upon all points, and under all circumstances.

Systematic arrangement at the outset will save time trouble, and disputes to an extent to deserve the early and most serious consideration of those who embark in the various and extensive operations involved in the construction of any considerable length of Railway.

In contract work, for instance, it is indispensable to keep always in view the relative progress of the work, the time fixed for its performance and the payments on account, which is effected by constant returns of the form annexed:—

No. ____________________RAILWAY.

*Comparison of Work done and to be done*____________________1850,
by the Contractors ____________________.

Total Earth Work	Earth Work Executed.	Ratio of Earth Work executed to the whole	Time allowed for completion of Works.	Time since Contract began.	Ratio of Time elapsed to the whole.	Total Price of Contract.	Sum Paid, including Reserve.	Ratio of Sum Paid to the whole.
C. Yards.	C. Yards.		Months.	Months.		£	£	

The question of a Government audit is scarcely one upon which to dwell at any length in a work of this description. In all Colonial Railways, the fixed and limited control of the Government will necessarily embrace such a degree of supervision over the financial department, as to effectually meet the object; but the sound policy of all public companies should induce the periodical publication of all their accounts, in a form so clear and explicit, so simple and intelligible, so full, and yet so well arranged, and authenticated by such responsible examiners, that no advantage could be shewn to attend any change, nor any necessity be admitted for an appeal to a higher tribunal. There are no more effectual means of preventing that distrust, which recent occurrences have, in so many instances, unfortunately forced upon the public, than by such unreserved and undisguised periodical statements of the affairs, whether favourable or otherwise, of the Companies, as to leave no room for doubt, no single element of possible uncertainty.

Railways may be classed for future application as high and low priced, and their adoption be regulated by and dependent upon the wants and resources of the country; a high priced line being understood to embrace the most substantial and permanent work with heavy rails; the low-priced lines, for branches and less important traffic, varying from a few hundred to a few thousand pounds per mile of single way, and so graduated in understood cost, as to permit of every variety, from the rough logs with longitudinal timbers and a plain bar rail, to the superior and more costly and durable description of work. There should be a Railway suitable to every country and every district, which, by judicious adaptation, should be brought within the resources and means of all.

In a future number, it is proposed to enter more fully on this important view of the subject.

The result of all experience tends to establish certain truths, which, in matters of locomotion, may be defined as the admitted axioms of Railway construction and working. Among these may be named the expediency of adopting the most direct line between any two important terminal points, in preference to the undulatory and winding course originally advised and adopted, with a view to embrace a greater number of towns in the route, which it is now found would be more advantageously accommodated by branches. The argument, however, has less force in England than in any new country, in which the relation between the trunk and the branches differs so materially; but for all Colonial lines, it may be assumed as indispensable to a sound and perfect system.

Among other undisputed points of Railway policy may be named that of never constructing two lines where one will suffice, a controlled and well regulated monopoly being preferable, as competition usually subsides into combination, and the public have to pay for the use of two capitals, when an outlay of one only was required.

The continued difference of opinion among engineers, in reference to the details which shall secure the most advantageous results, both in constructing and working Railways, forcibly attests the necessity for the enquiry which has been suggested into the comparative merits of the various plans in operation.

The object is partially obtained by the occasional discussions which take place at the meetings of the Institution of Civil Engineers, and the value of the opinions elicited from the most experienced members of the profession on the subjects from which their experience has been derived, cannot be too highly estimated. It is by no means an insignificant indication of the age, that the taste for scientific pursuits and enquiry is widely extending to all classes, and its useful application must be materially influenced by the greater or less existing facilities of intercommunication.

One important feature connected with the recent proposals for the introduction of Railroad communication into the Colonies, under a guarantee by the local governments of interest upon the capital so applied, deserves the serious attention both of the government and of the Railway contractors.

The establishment of a Land Association, simultaneously with the organization of the Railway Companies, will be the means of promoting the object in view under circumstances of more than ordinary advantage —the functions of the Land Association being limited to the purchase of the land adjoining the Railways, and after improving, to sub-let or otherwise dispose of it.

For the effectual attainment of the full benefits of this measure, it is indispensable that the machinery, by which its operations are conducted, should be entirely separated and distinct both from the government and from the Railway Companies.

The basis of the arrangements should be the payment by the Land Association to the local government of the amount paid to the proprietors of the land adjoining the Railway for the land taken for the purpose, which may be assumed, with a view to the great improvements which would be affected by such means, at 1,800 yards on each side of the line; and a further annual payment or rental to the local government by the Land Association of, say on an average, 10*s.* per acre, in addition to the cost of the land, for 99 years, when the whole should revert to the government.

The Land Association would be enabled to render considerable assistance to the government in determining and adjusting the value of the land taken, and, by accepting the transfer direct, would render any advances by the government on this account unnecessary.

The improvement of the property should be simultaneously proceeded with, by drainage and fencing, by intersecting it with roads, and, where needed, by buildings, or otherwise; and it would be speedily disposed of to emigrants or other respectable tenants.

The benefit of such a measure to the Railway will also be considerable, and an immensely increased value will be imparted to the whole of the surrounding land by the improvements effected upon that which immediately adjoins the Railway.

The financial view of the question will be as under:—the land subdivided into lots, as shewn on the annexed diagram, will vary in price according to local circumstances, but the after rental will correspond in price as being influenced by the same causes.

The land to be appropriated is assumed at 1,800 yards on each side of the line, of which, allowing 80 yards for the works, 1,760 yards on either side will remain, amounting to 2 square miles for each mile in length. The purchase price of the land will be regulated by its present value, which cannot, under any circumstances, be so high as it must be when brought under the influence of Railway communication. There will be 1,280 acres for every mile running of the Railway. If the Land Association pay the local government 10*s.* per acre rental, after paying the purchase-money, the result will be to the government:—

On 1 mile of Railway constructed, 1,280 × 10s. = £640 per annum; on 10 miles, £6,400; on 100 miles,

£64,000; on 1,000 miles, £640,000; and on 10,000 miles of Railway, £6,400,000 per annum clear income, without previous outlay.

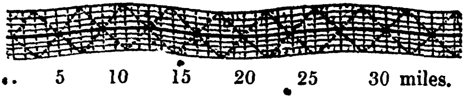
The results to the Land Association will be of corresponding advantage. The land will be sub-let or sold for the term of the lease, at a reasonable increase upon the cost, and assuming that a profit of 2*s.* 6*d.* per acre shall be charged, in addition to the interest on the purchase-money and improvements, the returns will be, on one mile, £160 per annum; on 10 miles, £1,600; on 100 miles, £16,000; on 1,000 miles, £160,000; and on 10,000 miles of Railway, £1,600,000 per annum.

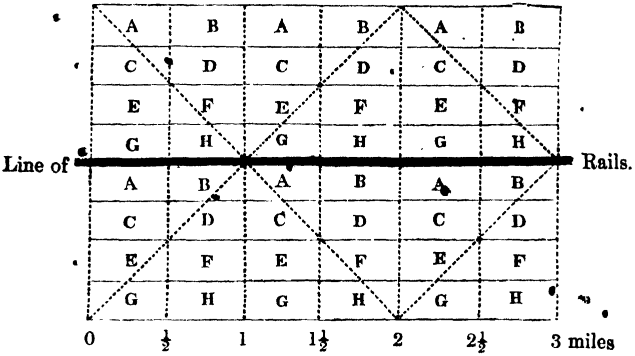
The calculations are based upon the admitted doctrine that the value of land must be increased, but cannot be diminished, by a Railway passing through or near it; and that it will be purchased by or through the instrumentality of the local government, under powers existing or taken for that purpose, at its value at the time of purchase.

Such an association, judiciously managed, would do much towards directing the surplus capital of Great Britain to the most useful and least insecure channels for investment. A guarantee fund for the extension of the Railway system would be provided from this source without burthening the government treasuries, as assuming that the Railways on an average cost £10,000 or even £12,000 per mile one with another, the land revenue would amount to £640 per mile against a 5 per cent. guarantee of £500 or £600.

The annexed wood-cuts shew the land lots adjoining the Railway, and the direction of roads which converge at 2 miles distance along the line.

The letters indicate the eight divisions of 80 acres, contained in each square mile.





The above is the illustration of a principle which will equally apply, whatever variation may be occasioned by local circumstances in any or all of the details, as the rentals will bear direct relation to the original outlay for purchase, improvement, government, rent, and superintendence.

The grandest works, out of England, both in respect of their magnitude and of their results, which have been designed for future and probably early consideration, are the American line of Railway of 3,000 miles, connecting the Atlantic with the Pacific oceans; the Canada line of nearly 1,000 miles; and the Indian lines, which, while connecting the seat of government with the extreme end of the territory, unite the Presidencies of Bengal and Bombay.

It is impossible to contemplate what has been effected through the instrumentality of Railways during the last few years, without casting a thought upon the probable future effect which, in the course of another few years, their further extension must occasion. British India, for instance, in 1840, was four months distant from Great Britain; a few years elapsed, and the overland communication brings us to within six weeks as an average. Let a few more years pass over our heads, and the continental system of Railways will have been completed, during which period it is probable that the interior of India will be traversed in all directions by these arterial sources of wealth and prosperity. The succeeding period will as assuredly be marked by yet more singular and unexpected results of the same powerful influence, and but a comparatively brief period will elapse ere the travelling distance between London and Calcutta will be reduced to ten days, and the telegraphic distance to a few hours.*

The policy of the country should prompt the earliest construction of the principal trunk lines in India, after which it matters not how soon the connecting lines are completed between the Delhi or Lahore end of the great trunk line, which traverses the country from the capital to the

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* Upon this subject it may be mentioned, that the proposal to establish a National Highway, by land, direct from Ostend or Havre to India, under special treaty with the several States traversed, has been submitted to the consideration of Her Majesty's Government, and that if the expectation of the co-operation of the Foreign States be realized, there is every reason to anticipate that considerable progress will be made during the next few years towards the completion of a colossal undertaking, of which the importance to British interests can scarcely be overestimated.

North West, and through Cabul or Beloochistan, Persia, and Asiatic Turkey, into the European network already in progress of rapid completion. Prudential considerations would, under any circumstances, necessarily defer the immediate promotion of the direct land approach to our Indian possessions, not from the apprehension of foreign aggression, which, in this case, would be conducted in a commercial and trading, and not in a warlike or hostile spirit, but for the more cogent reason that the disposable capital for such purposes will be for some years most usefully and profitably employed in the heart of our own territories.

That innumerable objections may be raised, and an infinite variety of difficulties suggested, first against the possibility, and afterwards to the probability of the extension of the benefits of the Railway system in the direction indicated, is to be expected. It will be consistent with the entire course of the Railway progress, from the cradle to maturity. It is not here needful to argue a point on which it is sufficient to have illustrated one, and not the least, of the advantages of a system. Its earlier or deferred application in any and all quarters of the globe is a point upon which an expression of opinion, founded on the manifest progress of events, may be permissible. The seeds have been widely sown, and the localities and extent of the harvest are not susceptible of precise definition.

It is very certain that great powers involve heavy responsibilities,—that the vast possessions and dependencies of this country are not entrusted to British rule and government without an ulterior object,—that the means of promoting the civilization and vital interests of millions of our fellow-beings are not placed in our hands and at our disposal to be trifled with or lightly regarded,—and that, through the instrumentality of Railways under British influence, that great and wonderful change, which is already in course of silent and certain operation, will be eventually effected throughout the East.

There are other considerations involved in the contemplation of the influence of Railways besides and beyond their political or commercial, their social or pecuniary points of view,—and of a nature to excuse what might otherwise be regarded as a digression.

The positive gain from Railway communication scarcely exceeds the benefit conferred by the prevention effectually interposed to the recurrence of such calamities as those referred to in the annexed note,* and which unfortunately are not confined to a single instance or a particular district.

It is impossible to conceive an enquiry fraught with more anxious and stirring interest than the probable future transit through those countries with which our early and holiest associations are identified. The lands of the Medes and Assyrians, of Ararat and Shinar, of Mosopotamia and the Chaldeans, of Babylon and Nine--veh, can scarcely be traversed without inspiring sentiments of no ordinary or transient character. Syria under its varying and wonderful phases of Palestine, and of

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* The pestilence, famine, and inundation which in 1831 combined to afflict and destroy thirty thousand persons in Persia, under circumstances which can scarcely be paralleled; and the successive famines which have occurred in India in the years 1811-1812, and subsequently, and may be referred to, the former in Fraser's *Kurdistan*, the latter, in the current chronicles of Indian history.

Canaan under the tribes, and during the Patriarchal and the Apostolic ages, has already obtained something beyond a passing thought. The exertions of Layard, Chesney, Fraser and others, have largely contributed to awaken an interest, which, though long latent, must exist so long as the world shall last in regard to those regions in which their labours have been so industriously directed.

The Biblical antiquarian will no longer exclusively appreciate the interest attaching to the localities of Susa, of Ecbatana with its sevenfold fortifications* and tunnelled aqueducts, and of the many sites connected with sacred and profane history, which have been so ably and lucidly investigated by Hughes and Williams.

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* "According to Herodotus, Ecbatana was built near the close of the eighth century, B. C. by Dejoces, the founder, or (as other authors say) the restorer of the Median monarchy."

"The Medes, in obedience to their king's command, built those spacious and massy fortifications now called Ecbatana, circle within circle, according to the following plan. Each inner circle overtops its outer neighbour by the height of the battlements alone. This was effected partly by the nature of the ground, a conical hill, partly by the building itself. The number of the circles was seven; within the innermost were built the palace and the treasury. The circumference of the outermost wall and of the city Athens may be regarded as nearly equal. The battlements of the first circle are white,—of the second, black,—of the third scarlet,—of the fourth azure,—of the fifth orange. All these are brilliantly coloured with different paints. But the battlements of the sixth circle are gilt with silver, of the seventh with gold. Dejoces constructed these walls around his palace for his own personal safety. But he ordered the mass of the Median nation to construct their houses in a circle round the outward wall."—*Herodotus*, B. I., c. 98, 99.

"For as the city was badly supplied with water, and there was no spring in the neighbourhood, with immense labour and expense

It would be an unsatisfactory and unavailing parallel to draw in this respect between the measures and policy of Great Britain as compared with America and the principal Continental States of Europe. The object of the present work is, in giving a concise epitome of Railways, to render it in some degree serviceable in their future application and extension, and while indicating the principal difficulties which have to be encountered and overcome, to afford the readiest means by which past errors and inconsistencies may be avoided.

The annexed short extract from the *Quarterly Review*, of December, 1848, may fitly terminate the few preceding pages. In the just, however imperfectly expressed sentiments it contains, there are few, who will not earnestly and cordially concur.

> "We trust that the wonderful discovery which it has pleased the Almighty to impart to us, instead of becoming among us a subject of angry dispute, may in every region of the globe bring the human family into communion; that it may dispel national prejudices, assuage animosities,—in short, that by creating a feeling of gratitude to the Power from whom it has proceeded, it may produce on earth peace and good will towards men."

Semiramis introduced abundance of excellent water, and furnished the whole city with copious streams. At the distance of twelve stadia from Ecbatana there is the mountain Orontes, of extraordinary ruggedness and height. The perpendicular ascent to the summit is twenty-five stadia. As there was on the opposite side of this hill a large lake, which discharged its waters into a river, Semiramis perforated the root of this mountain, and formed a tunnel fifteen feet broad and forty feet high. Through this she conveyed the lake-stream, and supplied the city with water."—*Diodorus Siculus*, p. 72.

FORM OF RETURNS.

CONSTRUCTION.

1	Expenses before Act	£
2	Land and compensation	,,
3	Contracts for works. A.	,,
4	Permanent way, timber, rails, and all materials. B.	,,
5	Locomotive engines and carriages, &c. C.	,,
6	Engine houses, tools, and machinery	,,
7	Engineering and surveying	,,
8	Advertising and printing	,,
9	Travelling expenses	,,
10	Law charges and conveyances	,,
11	Stamps for debentures	,,
12	Parliamentary expenses	,,
13	Maps, plans, &c.	,,
14	Office expenses, salaries, direction, postages, rent, &c.	,,
15	Discounts and commissions	,,
16	Electric telegraph	,,
17	Miscellaneous charges	,,
18	Total cost of construction	,,

WORKING EXPENSES.

		Per mile.	COST.
19	Maintenance of way	£	
20	Locomotive account, viz., coal, coke, repairs, wages, oil, tallow, and all incidental expenses. D.	,,	
21	Carrying account, viz., clerks, superintendents, &c. E.	,,	
22	General charges, viz., salaries, direction, and office charges. F.	,,	
23	Total working expenses	,,	
24	Government duty	,,	
25	Rates and taxes	,,	
26	Depreciation and replacing stock and plant	,,	
27	Total working expenses, duty, and depreciation	,,	

RECEIPTS.

			COST.
28	Passengers	£	
29	Carriages, dogs, and horses	,,	
30	Cattle	,,	
31	Merchandize	,,	
32	Parcels	,,	
33	Rents and sundries	,,	
34	Mails	,,	
35	Total Receipts	,,	

A. CONTRACTS FOR WORKS.

					COST.
		Cubic yds	Rate.		
36	Excavations			£	
37	Embankments			,,	
		No.	Length.		
38	Tunnels			,,	
39	Timber viaducts			,,	
40	Iron bridges, cast & wrought			,,	
41	Timber bridges			,,	
42	Stone bridges			,,	
43	Occupation bridges			,,	
			No		
44	Culverts, above 3 feet			,,	
45	Ditto, less than 3 feet			,,	
			Cubic feet.		
46	Timber not enumerated			,,	
			No.		
47	Terminal stations			,,	
48	Intermediate stations			,,	
49	Station engines			,,	
50	Tanks and water cranes			,,	
51	Miscellaneous			,,	
52	Average length of lead				
53	Proportion of hard rock cut through in earth works				
54	Proportion of earth and soft work in earthworks				
55	Proportion paid for materials				
56	Proportion paid for labour				
57	Total distance				
		Av.	St		
58	Average and steepest gradients				

CONTRACTS FOR WORKS CONTINUED—

		No.		COST.
59	Station signals and ticket apparatus for all stations		£	
60	Average cost per yard run of—			
	Excavations		,,	
	Embankments		,,	
	Tunnels....................		,,	
	Timber viaducts		,,	
	Iron bridges................		,,	
	Timber bridges		,,	
	Stone bridges		,,	

B. PERMANENT WAY.

			Rate.		COST.
		Cubic yds			
61	Ballast			£	
		No.			
62	Stone sleepers			,,	
63	Wood sleepers			,,	
64	Chairs..................			,,	
		Tons			
65	Rails			,,	
			lbs. per yard.		
66	Weight and section of rails ..				
		No.	Rate.		
67	Turntables..............			£	
		Qy.			
68	Switches, turnouts, sideings			,,	
69	Bricks and drain tiles			,,	
70	Cast-iron drain pipes.... .			,,	
71	Spikes and keys			,,	
			Yards.		
72	Telegraph wire and insulation .. .			,,	
			No.		
73	Telegraph supports			,,	
74	Telegraph station apparatus			,,	
75	Telegraph fixing			,,	
76	Laying rails			,,	
77	Filling in ballast			,,	
			Qy.		
78	Coating under blocks and felt......			,,	
			Yards.		
79	Fencing and quicks			,,	
80	Labour to fencing and quicks			,,	
81	Labour, miscellaneous			,,	

C. CARRYING STOCK.

		No.		COST.
82	Locomotive engines and tenders....		£	
83	First class carriages..............		,,	
84	Second class ditto		,,	
85	Third class ditto		,,	
86	Post office ditto		,,	
87	Luggage vans.......		,,	
88	Goods waggons..........		,,	
89	Coal waggons..		,,	
90	Horse boxes and cattle cages		,,	
91	Carriage trucks..................		,,	
92	Miscellaneous..		,,	

D. LOCOMOTIVE ACCOUNT.

93	Wages of engine men and firemen		£	
94	Waste, oil, tallow, water, and firewood......		,,	
95	Wages, labourers, and cleaners		,,	
96	Superintendents, clerks, salaries, and office charges		,,	
97	Repairs of engines and tenders		,,	
98	Coke	cwt.	,,	
99	Incidental charges........................		,,	
100	Assistant engines, all charges together	No.	,,	
101	Total locomotive account.................		,,	

E. CARRYING ACCOUNT.

102	Salaries—Booking clerks, and petty disbursements	£
103	Wages—Guards, and conductors	,,
104	————Police and inspectors	,,
105	————Switchmen, messengers, and porters	,,
106	Clothing	,,
107	Carriage and waggon repairs	,,
108	Stores consumed	,,
109	Waste, oil, tallow, fuel, and carrying incidental expenses	,,
110	Printing, stationery, and tickets	,,
111	Lighting and gas at stations	,,
112	Total carrying account for coach and merchandize traffic	,,

F. GENERAL CHARGES.

113	Salaries	£
114	Advertising	,,
115	Printing, stationery, ticket books, &c.	,,
116	Medical expenses	,,
117	Postages	,,
118	Law charges	,,
119	Travelling expenses	,,
120	Sundry office expenses	,,
121	Total general charges	,,

COMPARATIVE RESULTS.

		Passengers. Goods.
122	Average speeds	
123	Average passengers per train	
124	Average weight of goods per train	
125	Average scale of charges per mile, passengers—	
	First. Second. Third.	£
126	Average goods charges per ton per mile—	
	First. Second. Third.	,,
		P. G
127	Average quantity of coke used per mile run	,,
128	Average cost of oil and tallow per mile run	,,
129	Average cost of repairs per mile run	,,
130	Average cost of coke per mile run	,,
131	Average engineer's and firemen's wages per mile run..	,,
132	Average general charges per mile run	,,
133	Total cost per mile run	,,
134	Reconstruction per mile run....	,,
		Passgrs. Goods.
135	Total cost per train per mile run	
136	No. of miles run by each engine	
137	Number of passengers carried—	
	1st Class. 2nd Class. 3rd Class.	
138	Tonnage of goods carried—	
	Tons. 1st Class. Tons. 2nd Class. Tons. 3rd Class.	
139	Total receipts, No. 35	
140	Working expenses, No. 23	
141	Duty and rates, No. 24, 25	
142	Depreciation, No. 26.........................	
143	Total expenditure, No. 27	
144	Profit	
145	Per centage of expenditure to returns, viz:—	
	Working Expenses. Duty. Depreciation. Total.	

ESTABLISHMENT.

146	Direction	
147	Local management	
148	London establishment.—Secretary and clerks	
149	Local establishment.—Secretary and clerks	
150	Engineers' departments.—Engineers, surveyors, and draughtsmen	
151	Principal and intermediate station superintendents and clerks	
152	Repairing shops.— Superintendents, engineers, fitters, turners, founders, &c.	
153	Locomotive establishment.—Engine drivers, firemen, cleaners, &c.	
154	Carrying establishment.— Guards, conductors, clerks, porters, switchmen, police, warehousemen, signal men, &c.	
155	Construction of line.—Clerks of contracts, superintendents of works, labourers on line	
156	Maintenance of way.—Plate layers, bricklayers, labourers, of all descriptions, &c.	
157	Carriage and waggon construction department	

PAY LIST.

158	Detailed list of all classes employed by the Company	£
159	Rate of pay of each class	„
160	Aggregate pay of each class	„

Return of Cost of Materials and Labour to be filled up for every 10 M along the Line of Railway referred to.

161

	First Division.	Second Division.	Third Division.	Fou Divi
A.—What description of stone is found.				
B.—What does it cost delivered per 100 cubic feet				
C.—At what price can good bricks be delivered per 1000				
D.—What is the cost of brick masonry per 100 cubic feet, including all charges				
E.—What is the cost of skilled and of common labour per month				
F.—What description of timber is obtained in the neighbourhood ..				
G.—At what price delivered per 50 cubic feet.........................				
H.—What does limestone cost per 100 cubic feet				
I.—At what price are rails and chairs delivered				
J.—At what cost are coals, coke, and charcoal obtained.............				

FORM OF RETURNS UPON MASSACHUSSETS LINES.

Capital stock
Increase of capital since last report
Capital paid in, per last report
Capital paid in, since last report
Total amount of capital stock paid in
Funded debt, per last report
Funded debt paid since last report
Funded debt, increase of, since last report
Total present amount of funded debt
Floating debt, per last report
Floating debt paid since last report
Floating debt, increase of, since last report
Total present amount of floating debt

Total present amount of funded and floating debt
Average rate of interest per annum on do.

Cost of Road and Equipment.

For graduation and masonry, per last report
For graduation and masonry paid during the past year
Total amount expended for graduation and masonry
For bridges, per last report
For bridges, paid during the past year
Total amount expended for bridges
For superstructure, including iron, per last report
For superstructure, including iron, paid during the past year
Total amount expended for superstructure, including iron
For stations, buildings, and fixtures, as per last report
For stations, buildings, and fixtures, paid during the past year
Total amount expended for stations, buildings, and fixtures
For land, land-damages and fences, per last report
For land, land-damages, and fences, paid during the past year
Total amount expended for land, land damages, and fences
For locomotives, per last report
For locomotives, paid during the past year
Total amount expended for locomotives
For passenger and baggage cars, per last report
For passenger and baggage cars, paid during the past year
Total amount expended for passenger and baggage cars
For merchandise cars, per last report
For merchandise cars, paid during the past year
Total amount expended for merchandise cars
For engineering and other expenses, per last report
For engineering and other expenses, paid during the past year
Total amount expended for engineering and other expenses

Total cost of road and equipment

Characteristics of Road.

Length of road, [main road] - - -
Length of single track - - - -
Length of double track - - - -
Length of branches owned by the Company, stating whether they have a single or double track -
Weight of rail per yard in main road - -
Weight of rail per yard in branch roads - -
Maximum grade, with its length in main road -
Maximum grade, with its length in branch roads -
Total rise and fall in main road - - -
Total rise and fall in branch roads - - -
Shortest radius of curvature with length of curve in main road, [Radius 1,050 feet] - -
Shortest radius of curvature, with length of curve in branch roads, [Radius, 573 feet] - - -
Total degrees of curvature in main road -
Total degrees of curvature in branch roads -
Total length of straight line in main road -
Total length of straight line in branches -
Aggregate length of truss bridges - -
Whole length of road unfinished on both sides -

Doings during the Year.

Miles run by passenger trains -
Miles run by freight trains - -
Miles run by other trains - -
Total miles run - - -
Number of passengers carried in the cars
Number of passengers carried one mile
Number of tons of merchandise carried in the cars
Number of tons of merchandise carried one mile
Number of passengers carried one mile, to and from other roads - - - - -
Number of tons carried one mile, to and from other roads - - - - - -
Average rate of speed adopted for passenger trains, including stops - - - - -
Average rate of speed adopted for freight trains, including stops - - - -
Estimated weight in tons of passenger trains, including engine and tender, but not including passengers, hauled one mile - - - - -
Estimated weight of merchandise trains, including engine and tender, but not including freight, hauled one mile - - - - -

Expenditures for Working the Road.

For repairs of road, maintenance of way, exclusive of wooden truss bridges and renewals of iron - -
For repairs of truss bridges - - - -
For renewals of iron, including laying down - -
For wages of switch-men, gate-keepers and flag-men -
For removing ice and snow - - - -
For repairs of fences, gates, houses for flag-men, gate-keepers, switch-men, and tool-houses - -
Total for maintenance of way - - -

Motive Powers.

For repairs of locomotives
For new locomotives, to cover depreciation
For repairs of passenger cars
For new passenger cars, to cover depreciation
For repairs of merchandise cars
For new merchandise cars, to cover depreciation
For repairs of gravel and other cars
Total for maintenance of motive power

Miscellaneous.

For fuel and oil
For salaries, wages and incidental expenses, chargeable to passenger department
For salaries, wages and incidental expenses, chargeable to freight department
For gratuities and damages
For taxes and insurance
For ferries
For repairs of station buildings, aqueducts, fixtures, and furniture
For interest
For amount paid other companies, in tolls for passengers and freight carried on their roads, specifying each company, [Portland, Saco, and Portsmouth Railroad Corporation]
For amount paid other companies as rent for use of their roads, specifying each company
For salaries of president, treasurer, superintendent, law expenses, office expenses of the above offices, and all other expenses not included in any of the foregoing items, [including loss on passenger cars and freight cars worn out and broken up, 5,000 dollars

Income during the Year.

For Passengers:—
1. On the main road exclusively, including branch owned by Company
2. To and from other roads, specifying what:

For freight:—
1. On main road and branches owned by Company
2. To and from other connecting roads:

U. S. Mails, 6,098 dollars 76. Rents, 3,182 dollars, 73
Total income

Net earnings after deducting expenses

Dividends.

[Two dividends: one paid in July, 4½ per cent.; one paid in January, 1849, 4 per cent.]
Surplus not divided
Surplus last year
Total surplus

Estimated Depreciation beyond the Renewals, viz.:

Road and bridges
Buildings
Engines and cars

LONDON AND NORTH WESTERN RAILWAY.

SPECIFICATIONS OF STORES' QUANTITIES, 1850.

Bags, Baskets, and Ropes.—16 baskets, 1 bushel; 1,200 ditto to hold ½ cwt. of coke. 2,729 bags, ditto. 636 sheets, 2,000 square feet, felt, patent; 139 sheets ditto, tarred. 85 cwt. flax; 48 balls ditto, white; 0 ditto, spun. 220 lbs. hemp rope; 28 lbs. ditto, dressed; 92 lbs. ditto, green. 35 cwt. marline. 52 cwt. rope; 32 cwt. ditto, best white; 0 ditto, best tarred. 260 lbs. twine tufling. 2 cwt. tow. 560 lbs. twine, strong seaming; 368 lbs. ditto, middling; 224 lbs. Dutch; 0 ditto for stitching tarpaulins; 336 lbs. ditto tarred or pitched band. 60 cwt. yarn, spun.

Brass and Brass Work.—0 axle boxes, castings for. 1,000 feet beading, ½-inch. 0 bead frames. 0 bells, hand. 336 lbs. bushes. 336 bush sockets. 60 dozen bolts for sheets. 14 sets curtain rods and fixtures, bronzed. 12 gross curtain rings. 352 cwt. castings. 16 cocks, gauge; 8 ditto, cylinder cover; 8 ditto, blow off; 6 ditto, steam for pressure gauge; 24 ditto, pet, with union joints, complete; 16 ditto, mud; 16 ditto, tallow. 18 dozen escutcheons. 6 dozen glass string fasteners; 6 dozen ditto guides. 0 handles, ventilator, flush; 42 pairs ditto, 1st class door; 110 pairs ditto, ditto, re-plated; 42 pairs ditto, 1st class commode; 100 pairs ditto, ditto, re-plated; 36 pairs ditto, 2nd class, stiff. 30 gross holes, eyelet. 17 dozen hinges, $3\frac{1}{2} \times 2\frac{3}{8}$, $2\frac{1}{2} \times 2\frac{3}{8}$, $2 \times 2\frac{3}{8}$; 24 dozen ditto, lamp protector. 432 knobs on plates. 144 plates for door stops; 72 ditto, fence; 144 ditto, lap; 72 ditto, bottom; 0 ditto, ame to pattern. 1,428 lbs. sheet. 144 gross screws. 7 gross staples, hat string and door stop. 0 spring balances, Salter's patent, best description, say round. 0 60 lb. balances, varying in range from 8 to 10 inch; 0 70 lb. ditto, ditto; 12 80 lb. ditto, ditto; 0 90 lb. ditto, ditto; 0 100 lb. ditto, ditto; 0 120 lb. ditto, ditto; 0 140 lb. ditto, ditto; 50 90 lb. ditto, flat 6¼ inches. 0 syphons, flange, large; 0 ditto, small; 0 ditto, large ball; 0 ditto, small ball. 4 tons steps. 59 tons tubes, locomotive; to be made from the very best material, and to be sufficiently strong to keep themselves straight when put in the boilers; to be made to dimensions; and to be proved with an internal pressure of 300 lb. on the square inch, any diameter, length and gauge. 0 ventilator brasses. 5 lbs. wire, $\frac{3}{16}$ round. 224 lbs. wire to sizes. 12 whistles.

Brushes, Brooms, Mops, Mats, Pencils, &c.—36 brushes, dusting, 0000; 6 gum; 24 long-handled; 0 cushion; 36 blacklead, round; 120 stove; 324 spoke; 0 buffer; 240 scrubbing, &c., &c.; 0 hearth; 0 oil, round; 72 body; 144 banister; 480 sash tool 3, 4, 5, 6, 7, 8, 10, 12; 216 ground 0000; 336 sweeping; 0 steel wire; 240 paint; 24 sheet. 1,000 dozen brooms, birch; 9 whalebone; 34 hair; 18 banister; 1 carpet. 36 mats, door; 0 horse box. 28 dozen mops, wool; 0 rag. 37 pencils, duck liners sable, &c. 0 rugs, carriage; 0 guards.

Copper.—8,960 lbs. bolt, from ½ to 1½ inch diameter. 28 lbs. brads, 1 inch. 2,240 lbs. ingot. 336 lbs. pipe. 112 lbs. rivets, 11,200 lbs. sheet, various thicknesses and dimensions; 12,768 lbs. ditto for fire-boxes, ¾ and ½ inch thick, and cut to dimensions; 0 ditto shaded to sketches. 392 lbs. wire to sizes. 84 lbs. washers.—(The above to be of the best tough copper.)

Coach Trimmings, Carpeting, Cloth, Canvas, Flannel, &c.—0 binding, green. 120 yards bunting. 350 yards carpet, Brussels. 4,300 ditto canvas for sheets, to sample; 500 yards ditto for roofs, ditto; 6,000 yards ditto for glueing, ditto; 800 yards ditto for beetler, ditto; 200 yards ditto for dowlas, ditto; 500 yards ditto for derrys, ditto; 400 yards ditto for No. 6, ditto; 350 yards ditto for No. 2, ditto. 0 cloth, drab, inches wide; 1,040 yards blue, ditto. 100 yards damask, green. 0 ditto, cloth. 12 dozen dusters, linen. 12 dozen flannel, house. 6 dozen flags, white; 27 dozen ditto, red; 10 dozen ditto, green. 46 dozen hat strings. 480 holders and glass strings. 8,460 yards lace, seaming; 2,840 yards ditto, binding; 860 yards ditto, pasting. 930 square yards oil cloth, roof; 0 ditto, imitation morocco. 240 dozen roses. 40 yards silk, green; 300 yards ditto line. 30 gross tufts; 0 ditto daisy, with strings. 29 lbs. thread, drab; 29 lbs. ditto, white. 6 dozen towels, diaper. 30 yards velvet, black. 40 yards worstead cord. 1,500 yards webbing.

Coal, &c.—11,926 tons coal,* large; 1,223 tons ditto, Smiths'; 1820 tons ditto, cobbles; 2,680 tons ditto, slack; 1 ton ditto, dust. 454 tons cannel, for gas. 2,985 tons coke,† Smiths'.

Crucibles for Moulding Brass. To be made from the best clay, and warranted to stand the heat of the furnace for at least one whole day.—304 pots to hold 40 lbs. metal; 618 ditto 50 lbs. ditto; 545 ditto 60 lbs. ditto; 0 ditto 70 lbs. ditto; 422 ditto 80 lbs. ditto; 300 ditto 90 lbs. ditto; 350 ditto 100 lbs. ditto.

Colours, Varnishes and Drysaltery.—2½ cwt. black lead, in ½ lb. packages. 0 bronze, green. 414 lbs. borax. 672 lbs. Bolton polish. 2½ cwt. chrome yellow. 0 copperas, green. ½ cwt. Chelsea red. 0 Dutch pink. 5½ cwt. drop black. 22 cwt. dryers, patent, best quality. ¾ cwt. emery powder, Nos. 2 and 3; ½ cwt. ditto, No. 1. 35 reams ditto cloth, best quality. 4 cwt. gum. 262 gallons gold size. 110,000 leaves gold leaf, large pale; 2,500 leaves ditto, ditto deep. 44¾ cwt. glue. 31½ green, Brunswick; 2 cwt. ditto, quakers. 0 ivory black. 58 lbs. lake, crimson. 22 cwt. lamp black, common; 6 casks ditto, best vegetable. 0 ochre, spruce; ½ cwt. ditto, yellow; 13 cwt. ditto, brown. 13 cwt. paint, black; 20 cwt. ditto, mineral tar; 8 cwt. ditto, lead coloured; 22 cwt. ditto, green; 120 cwt. ditto, white; 60 cwt. ditto, protoxide (Todd's). 17 cwt. putty, best linseed oil and whiting in proper proportions, coloured if required. 500 lbs. Prussian blue, ground. 1½ cwt. potash, prussiate of. 1½ cwt. potash. 0 pipe clay. 35½ cwt. pumice stone, lumps. ¾ cwt. rotten stone. ¾ cwt. rosin. 99 cwt. red lead. 5½ reams sand paper. 5½ cwt. sugar of lead. 52 cwt.

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* LARGE COALS . .	Crewe . .	2500 tons
„	Edge Hill .	3950 „
„	Preston . .	630 „
„	Manchester	190 „
† SMITH'S COKE . .	Crewe . .	960 „
„	Edge Hill .	200 „
„	Preston . .	200 „
„	Manchester	35 „

soda. 1 cwt. umber, common English; 0 ditto, burnt. 192 lbs. vermillion, English; 62 lbs. ditto, Chinese. 256 gallons varnish, carriage; 500 gallons ditto, body; 42 gallons ditto, filling up; 252 gallons ditto, japan black; 10 gallons ditto, black naptha; 10 gallons ditto, red; 16 gallons ditto, copal. 465 cwt. white lead, first quality; 27½ cwt. ditto, ditto, dry. 33 cwt. whiting. 48 lbs. wax, shoemakers'. 32 lbs. wax, bees'.

Iron and Iron Work.—0 anvils—Hill's, P. Wright's, or Sanders' make, well steeled and hardened, and warranted for 12 months from time of delivery. 24 augers. 35 tons axles, carriage, hammered Yorkshire iron; 573 cwt. ditto, guards; 150 cwt. ditto, moulds; 125 ditto, patent shaft waggon, or lowmoor, to dimensions, and template; 0 ditto, common rolled, of scrap iron; 0 ditto, ditto, of bowling iron; 0 ditto, not turned. 16 cwt. bar iron, best hammered; 50 tons ditto, patent shaft; 190 tons ditto, fire or grate. 42¼ tons bolts, S. C. iron (various); 0 ditto, boot door. 13 tons bolts and nuts, S. C. iron and approved thread; 0 ditto ditto, to be made from best iron. 0 boxes, axle. 4½ cwt. brads, inch. 90 cwt. brake, guards; 200 ditto, shoes; 0 ditto, screws; 0 ditto waggon steps; 2 dozen ditto, door locks; 2 dozen ditto, chest locks; 320 cwt. ditto, levers of approved workmanship; 0 ditto, work to pattern. 80 cwt. buffer head moulds; 0 ditto hooks, S.C. iron; 0 ditto rods, ditto, to pattern; 10 cwt. ditto shoes, ditto. 102 tons castings, No. 1, best metal; 2½ tons ditto, malleable iron. 200 yards (700 cwt.) chain, coil, of approved quality; 18 cwt ditto, crane, to be short linked, made of the best cable chain iron, and tested to standard weight; 240 cwt. ditto, coupling and hooks, best possible quality, of patent shaft iron, warranted; 120 yards ditto, dog; 0 ditto, side, to pattern, of best scrap iron; 30 cwt. ditto, bolster. 0 connecting rods, S. C. iron. 0 corner plates, S. C. iron. 90 gross cotters, split. 40 cwt. charcoal plate. 0 draw bar ends, best. 200 grease covers, best charcoal plate. 0 handles for breaks. 78 hammers, hand, well steeled and hardened; 0 ditto, sledge. 96 pair hinges, butt, cast according to sizes; 200 pair ditto, ditto, wrought ditto; 0 ditto, footplate ditto; 0 ditto, box; 36 pair ditto, cross garnet. 0 hooks, can; 0 ditto, dog; 0 ditto, grab; 0 ditto, hand; 0 ditto, lead; 18 cwt.

ditto, sheet; 0 ditto, timber. 0 hooks, truss; 0 ditto, wool; 0 ditto, yoke. 48 tons iron, lowmoor or bowling. 0 iron work, wrought for horse boxes. 10 dozen keys, locker. 100 cwt. knees, S. C. iron. 5 dozen knives, grease. 12 dozen keys, carriage door. 12 locks, door; 96 ditto, cupboard and box; 12 dozen ditto, pad; 90 dozen ditto, spring box, large; 9 dozen ditto, ditto, small; 14 ditto, patent waggon. 0 lamp irons; 0 ditto, small. 0 moulds, S. C. iron. 1 cwt. nails, 4 inch, rose head and clasp, of approved quality; 43 cwt. ditto, 2½ inch ditto; 88 cwt. ditto, assorted; 5 cwt. ditto, *2d.* and *3d.* clouts. 0 name and number plates, of malleable iron. 200 gross nuts, ⅜ and ¾ inch. 140 mille panel pins, inch and ½ inch. 2 cwt. pig-rail hoops; 0 ditto pins; 0 ditto studs. ½ cwt. pins, coach, assorted. 60 tons pig iron, Staffordshire, various Nos. 0 pig iron, Welsh, various Nos.; 0 ditto, Shropshire, ditto. 0 rakes. 69 cwt. rivets, good quality. 6 saws, various sizes; 24 ditto blades. 36 pairs scissors. 0 scrap iron, rolled. 6,360 gross screws, for wood, of best quality. 9 cwt. screws, coach, of best quality. 41 screw jacks (to sample). 4 dozen scuttles, coal. 0 shackles, spring; 302 ditto, of best Lowmoor iron. 280 tons Staffordshire iron, best rolled; 233 tons ditto, in bar, flat, square, round and rod; 6 tons ditto, hoop; 61 tons, ditto, sheet; 33 tons ditto, plates; 9 tons ditto, angle; 30 tons ditto, axles, straight (patent); 6 tons ditto, ditto, cranked; 172 tons ditto, tyre bars, according to weight. 6 dozen shovels; 389 ditto, fire, for locomotive engines; 131 ditto, for cokemen; 24 ditto, for moulders. 0 steps to pattern. 2 tons Staples, S. C. iron; 1 ton ditto, draw. 0 slings, chain. 200 slide rollers. 200 spring fasteners, S. C. iron. 1 dozen spuds (straight). 1 dozen stoves (to sample). 1,278 mille 3½ cwt. tacks. 100 ticket holders. 0 tyres, Lowmoor and Bowling. 1 ton uses or forged iron work. 0 vices, to be the best bright patent washer vices, with counter threads, and warranted for 12 months from time of delivery. 10 cwt. 20 gross washers, Staffordshire plate. 4 cwt. ditto, ⅜ in. ½ in. ⅝ in. ¾ in.; 230 gross (60 cwt.) ditto, various. 300 sets wheels, new, to specifications and drawings, at per set of 4 wheels and axles. 80 sets wheels, retyred, lowmoor or bowling, 4½ in. and 5 in. wide, and 1¾ in. thick. 70 sets wheels, chilled; 0 ditto, truck; 250 ditto, centres, cast to sample, large; 250 ditto, ditto small. 10½ cwt. wire, to size. 430 feet wire gauze. 84 wrenches, monkey, best description; 0 ditto, screw. 0 Yorkshire bars, best, 0 ditto, flat; 13 tons ditto, square; 0 ditto, round; 0 ditto, rod. 0 Yorkshire, best, hoop; 15 tons ditto, sheet; 0 ditto, ditto, cut to section; 15 ditto, plates; 0 ditto, hammered; 4 ditto, angle, 0 ditto, axles, straight; 0 ditto, ditto, cranked; 120 ditto tyre bars, according to weight.

Lamps and Lamp Materials.—12 gas consumers. 24 lamps, buffer; 0 ditto, tender; 20 ditto, gauge; 0 ditto, gauge and hand; 36 ditto, guards; 0 ditto, tail signal; 0 ditto, roof; 96 ditto, hand; 72 ditto, tricolour; 0 ditto, side; 0 ditto, gas lighters'; 0 ditto, station signal; 0 ditto, reflectors, plated; 200 ditto, irons, small; 56 lbs. ditto cotton (to sample); 48 gross ditto, solar; 12 gross ditto, Argand. 132 lbs. lamp cotton ball; 100 gross ditto ditto tape; 0 ditto glasses; 12 ditto glasses, globe; 12 gross ditto ditto, solar chimneys; 0 ditto ditto, Argand; 2 dozen ditto ditto, bent red; 2 dozen ditto ditto, bent green; 132 boxes ditto wicks, wax; 0 ditto, ditto, round; 0 ditto, ditto, flat; 0 ditto, ditto, long; 60 ditto rings, roof; 200 ditto block rims; 0 ditto blocks; 0 ditto signal glass, white, cut to sizes; 0 ditto ditto, green; 0 ditto ditto, red, cut to sizes.

Leather, &c.—0 bags, cash. 0 belts, guards'. 224 lbs. belt. 224 lbs. buffer. 0 cases, flag. 0 leggings. 1,344 lbs. cuttings, 25 hides double straps. 12 pairs glass strings, bridle middlings. 1,900 feet hose pipes, patent, to any length or size. 132 horse head collars. 0 hides (rounded), to sample; 1,456 lbs. ditto, harness, ditto; 1,060 lbs. ditto, white horse, ditto. 6 dozen kip. 2,044 lbs. pipe and buffer. 10 dozen skins, morocco, claret; 5 dozen ditto, ditto, blue; 4 dozen ditto, calf; 2 dozen ditto, brown bazils; 156½ dozen ditto, chamois. 1,060 lbs. strap, hides for machinery; 1,600 ditto, luggage. 392 lbs. sole, butt. 100 lbs. white. 0 washers, axle box.

Oil, Tallow, Candles, Turpentine and Waste.—36 lbs. candles, composition; 8½ cwt. ditto, best store; 55 cwt. ditto, green dips. 31,652 gallons oil, patent olive, samples to be sent with tender;

142 tons 15 cwt. ditto, rape, best refined, suitable for locomotive engines, to be free from acid; 4 tons 10 cwt. ditto, linseed, best raw; 25 tons 9 cwt. ditto, boiled; 2,350 gallons ditto, Southern; 28 tons ditto, palm; 54 gallons ditto, neats' foot; 6 flasks ditto, salad. 102 tons tallow, St. Petersburgh, picked, Y. C. 10¾ tons turpentine, best English. 250 gallons tarpaulings, mixture for. 86 tons waste, cotton, for cleaning engines (clean rough samples to be sent with tender); 26½ tons ditto, ditto, white, best quality.

Steel and Steel Work.—379 files, best warranted (cast), for mechanics, of all sizes and descriptions, and of full standard weight (discount off list); 4 dozen ditto, saw. 102 dozen piston rings, best, warranted 15 ⅛ in.; 6 sets ditto, ditto, 14 in. 6 sets steel, best warranted, cast, for turning tools; 165 cwt. ditto, ditto, for taps and dies; 9 cwt. ditto, ditto, for chisels; 9 cwt. ditto, ditto, double shear steel; 19 cwt. ditto, ditto, common shear steel; 10 cwt. ditto, ditto, single shear steel, first quality; 8 cwt. ditto, ditto, ditto, common; 5 cwt. ditto, ditto, blistered, best quality; 45 cwt. ditto, ditto, spring ⅜ and 5/16; 34 tons ditto, ditto, octagon; 0 ditto, ditto, key and drift. 10 cwt. steel, best warranted ferrule, flat or bevelled; 33 cwt. ditto, ditto spring, selected, manufactured from Swedish iron; 0 ditto, best warranted, cast piston rods; 0 ditto, ditto, slide bars; 0 ditto, ditto, cast chisels; 0 ditto, ditto, drills 50 cwt. springs, best, warranted, engine; 40 cwt. ditto, ditto, tender; 340 sets ditto, ditto, bearing, to pattern; 105 sets ditto; ditto, buffer, ditto; 200 sets ditto, ditto, draw bar; 3 tons ditto, ditto, horsebox and truck; 4 tons ditto, ditto, spiral; 0 ditto, ditto, elliptical; 380 sets ditto, ditto, patent buffer.

Timber and Wood Work.—19,367 feet alder planks, 3¼ in., 4 in. 4¼ in., various lengths and widths. 0 ash ribs, bent by steam. 600 cubic feet alder planks. 0 ash logs; 145 loads ditto planks. 40 loads birch logs; 0 ditto planks. 10,000 feet baywood boards. 0 boxes, guards'; 0 ditto, lamp. 0 barrows, luggage basket. 460 buffer blocks, 3 × 14 circular; 300 ditto socket, to pattern. 0 boards, tail end signal. 0 beech timber. 250 bundles chisel rods, best tough. 2,000 deal battens, best Gottenberg. 91,000 feet super deal boards, yellow 1 in., 1¼ in. and 1½ in., of best and second quality; and 3 in. by 11 in. best crown archangel plank, dry, and free from knots, saps and shakes, both of 9 in. 11 in. wide, in 21 feet lengths. 2,400 cubic feet deal battens, archangel; 500 ditto planks; 6,000 cubic feet (1,500 feet super) ditto Dantzic, best quality; 0 ditto, red. 40 loads elm logs, American, best quality; 0 ditto, English. 0 felloes. 24 dozen file handles, ash or beech. 36 dozen hammer shafts; 310 dozen ditto handles, best sledge, ash, dressed to pattern, free from knots and shakes; 24 dozen ditto hand, ash, ditto. 0 ladders, 12 round; 0 ditto, 14 ditto; 0 ditto, 15 ditto; 0 ditto, 16 ditto; 0 ditto, 18 ditto; 0 ditto, step; 0 ditto, lamplighters'. 18 levers. 0 limewood butts. 4 mahogany logs. 0 oak logs; 0 ditto butts; 0 ditto staves; 6,000 cubic feet ditto, English, well seasoned, sound, and clean; 3,000 cubic feet ditto, American, ditto, best white; 25 loads ditto, plank. 1,500 pig rails; 1,000 ditto, posts. 0 pine logs; 100 ditto planks. 8 loads poplar or willow planks. 12 pails. 5,000 feet square, 6,000 feet cubic pine boards (yellow), perfectly seasoned, dry, clean, and bright, of first-rate quality, and free from sap and shakes, in boards, 11 in. wide, ½ in., ¾ in. thick; 0 ditto 11 in. wide, 1 in., 1¼ in., 1½ in., 1¾ in., 2 in.; 0 ditto 11 in. wide, 2¼ in., 2½ in., 3 in., 3½ in., 4 in. 80 loads pine pitch, best quality; 20 loads ditto, yellow, ditto. 3,200 poplar brake blocks, best, cut to pattern, 4 in. thick, to be free from shakes, and all other defects, each (according to size or average); ditto, 3½ in. thick. 2,500 elm ditto, ditto. 0 pine laggings, to be 2 in. wide and 1 thick, to be cut from dry and well-seasoned boards, free from knots, shakes, &c.; to be planed, grooved, and finished to pattern; to vary in lengths from 8 to 14 feet. 3,352 feet ditto lagging board, 1¼ in. 0 quarter sweeps. Scantlings, best English oak or ash, cut to the following sizes, die square, free from sap, shakes, knots, and selected straight, &c., free from all defects:—5,000 ft. cube, of all dimensions, 7 feet by 16 in. by 6 in.; 7½ feet by 12 in. by in.; 8 feet by 24 in. by 6 in.; 7 ft. by 12 in. by 6 in.; 8 ft. by 15½ in. by 6 in.; 8 ft. by 15½ in. by 6½ in.; 14 feet by 11½ in. by 3¾ in.; 6 ft. 6 in. by 11½ in. by 5 in.; 7 feet by 16 in. by 9 in.; 4 feet 6 in. by 11½ in. by 4¾ in.; 4 ft. by 9 in by 3¾ in.; 7 ft. 6 in. by 16 in. by 6 in.; for carriage buffers; 11½ in. square, for ditto, 16,000 feet super ditto oak, well seasoned, free from knots, shakes and sap, of all dimensions; 8,000 feet super ditto, American. 0 pitch pine ditto (St. John's). Sycamore, best English, in plank, selected straight and clean, free from all shakes, &c., and all other defects:—30,000 feet, of all descriptions, in planks, 1 in., 1½ in., 2 in.; 2½ in., 3 in., 3½ in.; 4 in., 4½ in., 5 in. 0 sticks, flag. 8 gross scotches. 0 steps, private carriage. 0 stands, lamp. 0 willow butts. 0 yokes.

Tin, Zinc, Lead, and other Metal.—0 lead, ingot; 34 cwt. ditto, sheet; 114 cwt. ditto, pig. 126 cwt. patent white metal, Fenton's (castings); 2 cwt. ditto, Babbitt's; 0 ditto castings 4 dozen paint kettles, double B. tin, 3 pints; 4 dozen ditto, 3 quarts. 8 cwt. spelter, coarse; 0 ditto, fine. 116 cwt. tin, block, best. 600 sheets tin, x x single; 1,211 sheets ditto, x x x double. 72 ditto cans, grease; 36 ditto, water; 12 ditto, oil, 10 gallons. 0 ditto, funnels; 11 dozen ditto, feeders; 0 ditto, dust pans. 0 oil tanks, with 2 cocks and union joints, complete; 0 ditto, with 3 ditto; 0 ditto, with 4 ditto; 0 ditto, with 5 ditto. 0 zinc, ingot; 0 ditto sheet.

Sundries.—12 aprons, washers, to pattern. 4 gross buckles, japanned roller, 1½ in. 0 binding, blue. 24 buckets, gutta percha; 72 ditto wood. 27 gross congreves, boxes of. 0 carriage covers, various sizes. 1¼ cwt. chalk. 0 glass plate, to pattern and sizes; 2,628 feet ditto, plate; 12 reams ditto paper, 1, 2, 3, best quality; 13 cwt. ditto gauge glasses for locomotive engines, to any length or diameter, to be of Newcastle make, well annealed. 0 glass, various; 4 dozen ditto, tumblers; 6 ditto, water bottles. 0 gutta percha belts, best, to any width, length, or thickness. 0 handles for breaks. 70 cwt. hair, curled. 96 doz. ivory studs and nails. 0 knobs, or bronzed plates. 1 cwt. links, pitch. 1 dozen needles. 28 reams paper, cabinet, Nos. 1, 2, 3. 12 dozen polishing paste, pots. 4 cwt. pitch. 31 pieces ribbon, china. 60 pieces sponge, best; 62 pieces ditto, middling quality. 0 springs, ventilator. 215 dozen signals, fog. 14¾ cwt. soap, brown, 1st quality; 211 firkins ditto, soft; 2 cwt. ditto, curd; 3 cwt. ditto, yellow. 18 dozen stones, hearth. 5 barrels, tar, Stockholm.

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